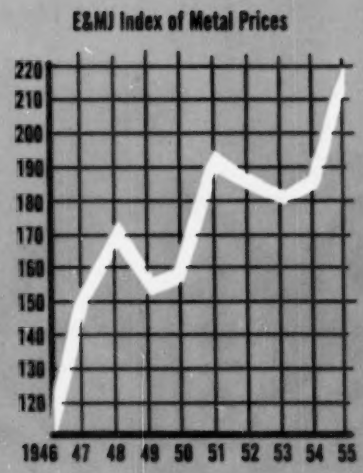
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

FEBRUARY 1956

FOUNDED 1866

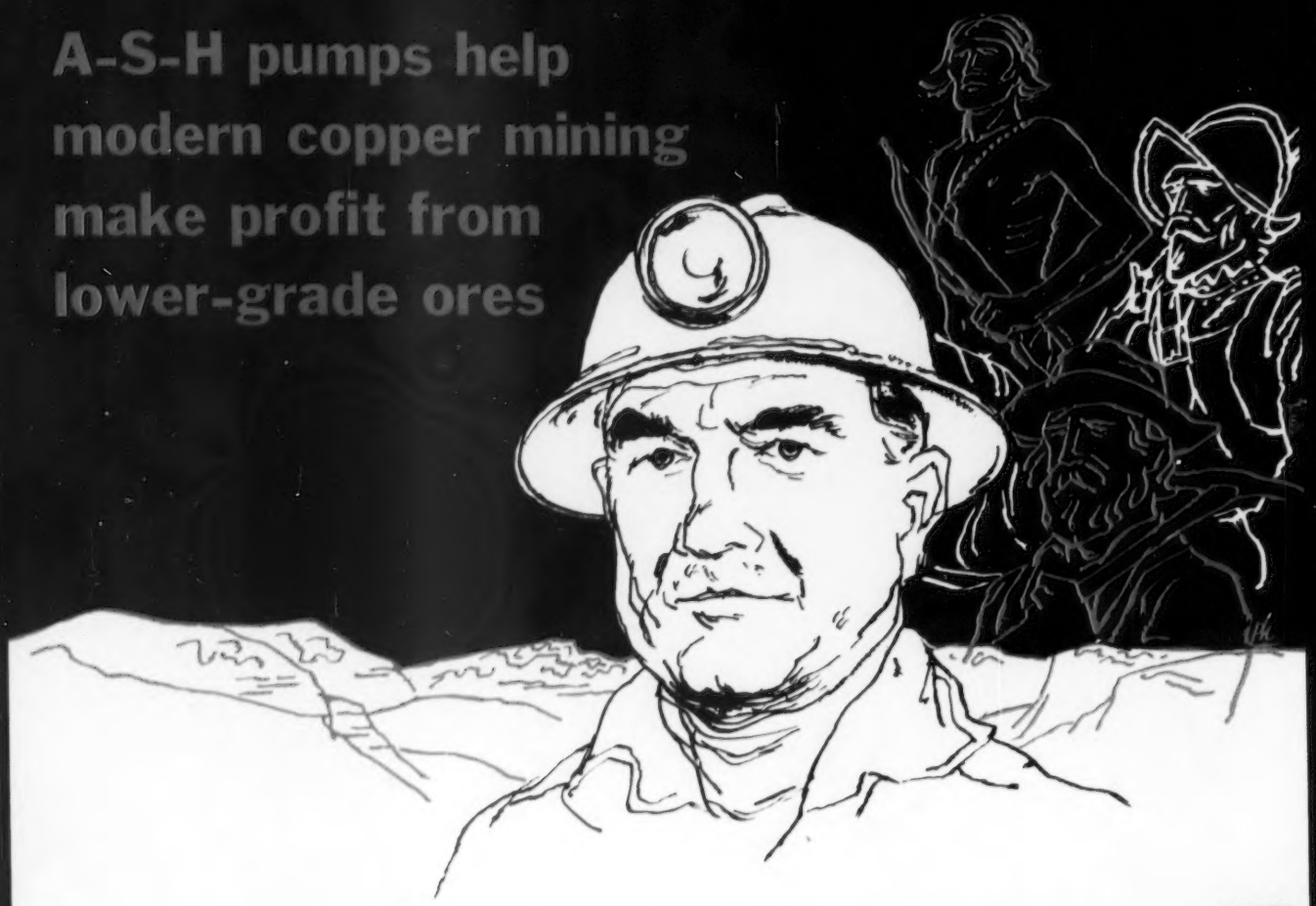
PRICE ONE DOLLAR



87TH Annual Survey And Outlook

GOLD
SILVER
COPPER
LEAD
ZINC
ALUMINUM
URANIUM
MAGNESIUM
TITANIUM
TIN
MERCURY
LITHIUM
BERYLLIUM
ZIRCONIUM
TANTALUM
ANTIMONY
CADMIUM
ARSENIC
BISMUTH
PLATINUM
THORIUM
RARE EARTHS
SELENIUM
NICKEL
COBALT
MANGANESE
CHROMIUM
TUNGSTEN
MOLYBDENUM
SULPHUR
PHOSPHATE
ASBESTOS
VERMICULITE
PERLITE
BARITE
FLUORSPAR
FELDSPAR
MICA
POTASH
MINING
MILLING
IRON ORE
METALLURGY

A-S-H pumps help modern copper mining make profit from lower-grade ores

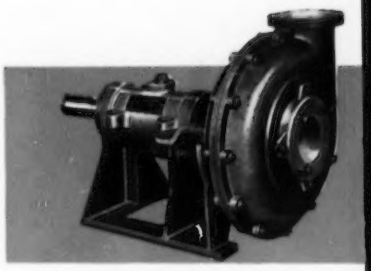


To meet the present demand for copper—and its accompanying molybdenum, modern mining techniques with improved equipment are being applied to lower-grade-ore deposits that heretofore have been by-passed for economical reasons.

The economical touchstone of this trend is greater efficiency, which explains why the equipment of a large operation in the arid Southwest includes 15 Hydroseal Vertical Sump pumps and 70 Centriseal Slurry pumps. Water being at a premium on location, Centriseals were selected for use in processing and tailings disposal because they operate without gland water. In both types of pumps, their easily-replaced wearing parts of tough moulded rubber outlast metal equivalents many times.

We have the pumps and the applicative experience to help solve your abrasives-pumping problem. Write us.

HYDROSEAL
VERTICAL **sump pump**



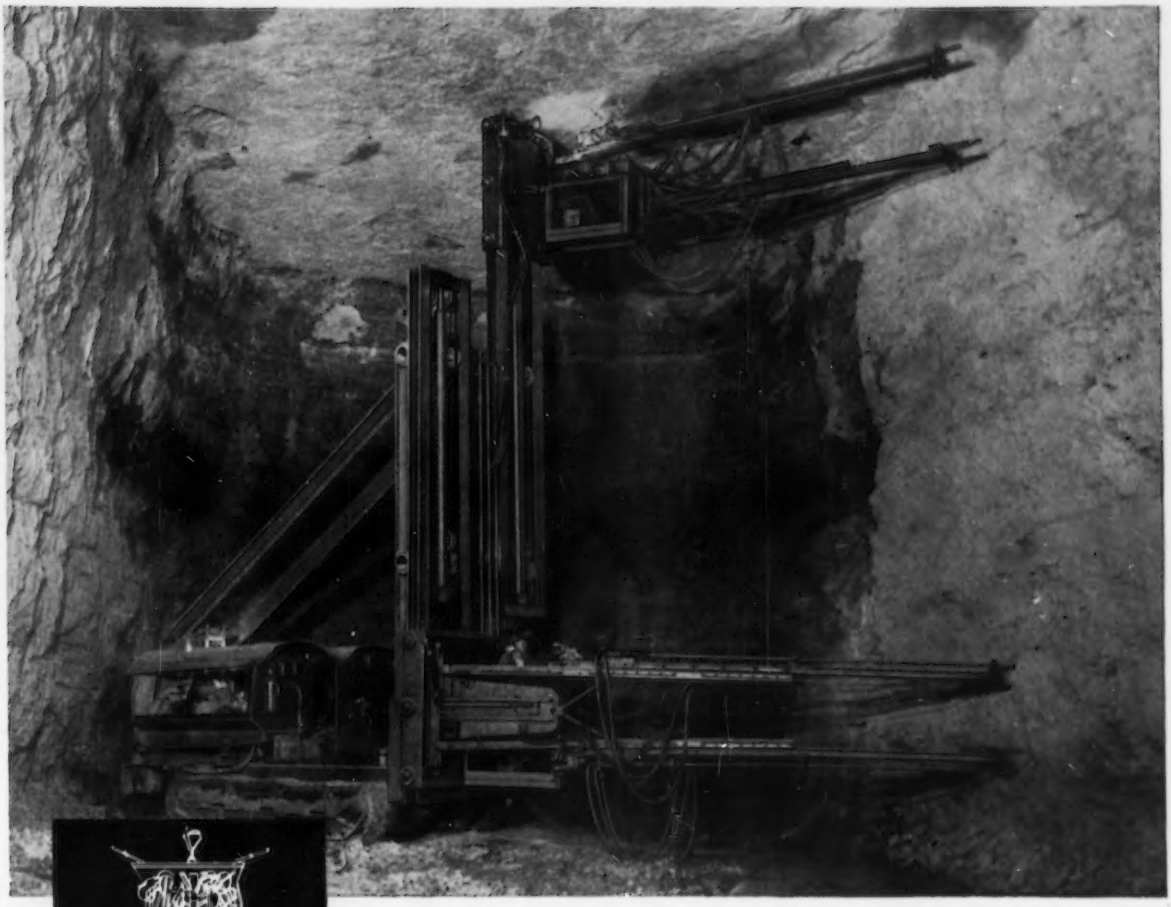
INTERCHANGEABLE

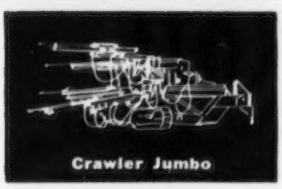
***CENTRISEAL* Slurry Pump**
(No Sealing water)

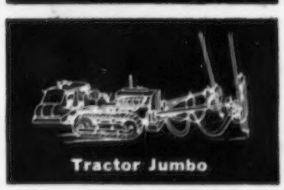
HYDROSEAL Slurry Pump
(Sealing water)

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

CENTRISEAL and HYDROSEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED







BIG JOBS OR SMALL ONES

I-R HYDRA-BOOM JUMBOS

mean faster, easier rock drilling

THE HUGE, self-powered and self-propelled Hydra-Boom drilling rig shown above was designed and built by Ingersoll-Rand for use in a large, underground limestone mine. With two extendable towers, each carrying two centrally-controlled Hydra-Booms, it gives complete coverage of a 40-foot high face.

Other typical Hydra-Boom drilling rigs are illustrated at the left, showing the *unlimited versatility* of these fast-acting, hydraulically operated boom mountings. Wherever you need effortless, fingertip control of drill spotting – wherever you want to convert setup time into drilling time – it will pay you to do the job with a Hydra-Boom rig. Let us help you engineer your unusual drilling problems. Write today, also ask for your free copy of Bulletin No. 4162.

Ingersoll-Rand 5-273

11 BROADWAY, NEW YORK 4, N. Y.

DRIFTERS • JACKHAMERS • DRILLMASTERS • QUARRYMASTERS • CARSET BITS • AIR TOOLS

90th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

VOL. 157 NO. 2

FEBRUARY 1956

87th Annual Survey and Outlook

METALS		Cadmium	107
Gold	76	Selenium	108
Silver	80	Lithium	108
Copper	82	Thorium	109
Lead	84	Mercury	110
Zinc	86	Rare Earths	111
Tin	88	Beryllium	112
Uranium	90	Bismuth	112
Aluminum	92	Arsenic	243
Magnesium	95	NON-METALLICS	113
Titanium	96	Sulphur	114
FERROALLOYS	97	Mica	114
Nickel	98	Fluorspar	115
Cobalt	99	Feldspar	117
Manganese	100	Barite	117
Chromium	101	Perlite	118
Tungsten	102	Vermiculite	119
Molybdenum	103	Phosphate	119
MINOR METALS	104	Asbestos	122
Zirconium	105	Potash	126
Columbium-Tantalum	105	MINING	127
Platinum Group	106	ORE DRESSING	133
Antimony	107	METALLURGY	137
		IRON ORE	141

Regular Departments

New Products Digest	35	Behind the By-Lines	74
Editorial	67	Personals	144
E&MJ Outlook	68	Operating Ideas	148
Markets	69	Washington Impact	152
This Month in Mining	72	New Books	156

Carl Coash ..... Publisher — Alvin W. Knoerr ..... Editor

George P. Lutjen, Managing Editor — Lloyd E. Antonides, Assistant Editor — George H. Cleaver, Market Editor

John B. Huttl, Associate Editor San Francisco — James W. Franklin, Assistant Editor — F. Alvin Zimmerli, Assistant Editor Layout

Daniel P. Eigo, News Editor — John R. O'Connell Jr., Assistant Editor Markets — McGraw-Hill Washington Bureau

Nancy Parkes, Copy Editor — William H. McNeal, Research Manager — John Donaldson, Natural Resources

Raymond H. Smalley, Business Manager — Alan E. Adams, Labor

Published monthly with an additional issue in mid-June by McGraw-Hill Publishing Co., Inc., James McGraw (1860-1948), founder.

Executive, Editorial, Advertising and Subscription Offices: **McGraw-Hill Building, 330 West 42nd St., N.Y. 36, N.Y. Publication Office, 1309 Noble St., Philadelphia 23, Pa.** Donald C. McGraw, president; Paul Montgomery, executive vice-president; Joseph A. Gerardi, vice president and treasurer; John J. Cooke, secretary; Nelson Bond, executive vice president, Publications Division; Ralph R. Smith, vice president and editorial director; Joseph H. Allen, vice president and director of advertising; J. E. Blackburn, Jr., vice president and circulation director.

Subscriptions: Address correspondence to **Engineering and Mining Journal—Subscription Service, 330 West 42nd St., N.Y. 36.** Allow one month for change of address.

Subscriptions are solicited only from management, production and maintenance executives and engineers in the metal and nonmetallic mining and refining industry. **Position and company connection must be indicated on subscription orders.**

Branch Offices and District Managers: **Atlanta 3,** S. T. Henry; **Chicago 11,** F. W Roets, G. A. Mack; **Cleveland 15,** J. E. Lange; **Dallas 1,** G. L. Jones Jr.; **Los Angeles 17,** G. A. Fruhling; **New York 36,** H. C. Chellson, J. W. Patten; **Pittsburgh 22,** Wm. H. H Ginder; **Philadelphia 3,** J. B. Lewis; **St. Louis 8,** F. W. Roets; **San Francisco 4,** J. W. Otterson; **Washington 4, D. C.,** London address: H. Lager. McGraw-Hill Publishing Co., Ltd., McGraw-Hill House, 95 Farrington St., London E.C. 4, England. **Cable address: McGRAW-HILL, London. News Bureau:** Atlanta 3; Cleveland 15; Detroit 26; Houston 25; San Francisco 4; Washington 4.

World News Offices: London, Frankfurt, Manila, Mexico City, Paris, Sao Paulo, Tokyo.

Price of this issue $1.00. Subscription rates: United States and possessions $3 a year; $4 for two years; $5 for three years. Canada $5 for a year; $8 for two years; $10 for three years. Other Western Hemisphere and Philippines, $8 a year; $12 for two years; $16 for three years.

Elsewhere, $15 a year; $25 for two years; $30 for three years. **Please indicate position and company connection in all subscription orders.**

Entered as second class matter May 24, 1951 at the Post Office at Philadelphia, Pa., under the Act of March 3, 1879.

Copyright 1956 by McGraw-Hill Publishing Co., Inc. All rights reserved. Printed in the U.S.A.

LETTERS

AMC at Las Vegas

I should like to call your attention to an error in your report of the Las Vegas AMC meeting, (*E&MJ* November 1955, p 100). In quoting Mr. Otto Wiesley, (page 103), you give as the maximum radon concentration the improper figure of 300 micro milie (sic!) curies per liter. This should be 300 micromicrocuries per liter instead.

Howard L. Kusnetz
Salt Lake City, Utah

• We stand corrected.—Ed.

Complementing the Law

With reference to your editorial "Congratulations Wyoming" in the October 1955 issue of *E&MJ*, p 67, your point is certainly well taken, but the last statement ". . . each state, . . . can stimulate mining appreciably by supplementing the Federal law with up-to-date provisions . . . and accept modern exploration techniques as valid assessment work." is not completely accurate. It is true that Federal law can be supplemented by State law, but it cannot be *changed* or made more lenient by State law. Therefore, the Federal requirement of $100 worth of labor or improvements on or for each claim cannot be alleviated by the States to include geophysical work (we assume this is what you mean by "modern exploration techniques") until the Federal law is changed in this respect. Otherwise, we are sure that some of the States would have enacted some such measure by now, and we most certainly would have had the matter up before our own Territorial Legislature at least three years ago. My remarks pertain only to laws affecting assessment work on claims on Federally-owned lands.

With regard to Wyoming's discovery work requirements, since Federal law does not require discovery work in the first place, Wyoming can do anything with that subject she wishes—even to abolishing it. Alaska has had a unique law for many years that you may not have heard of: Only two placer claims can be staked by any one person in any one recording district in any one calendar month.

James A. Williams
Department of Mines
Juneau, Alaska

• We agree that "modern exploration techniques" could easily be interpreted to include geophysical prospecting and thus would be misleading. State laws can spell out what constitutes valid assessment work more clearly, provided the measures adopted are within the framework of the Federal law which is very vague to say the least. It would be interesting to see some state legislature come out boldly with a list of items which could be accepted as assessment work instead of letting these items be thrashed out in the courts for clarification as they have in the past.—Ed.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Now they cut through rock with fire

A typical example of B. F. Goodrich improvement in rubber

THE white flame shooting out of the metal pipe is 3800 degrees hot. So hot that it eats through 25 feet of solid granite in *an hour*—something that used to take two men with drills all day long. The spitting fire is made right there in the pipe—a mixture of oxygen and fuel oil fed to the pipe through rubber hose.

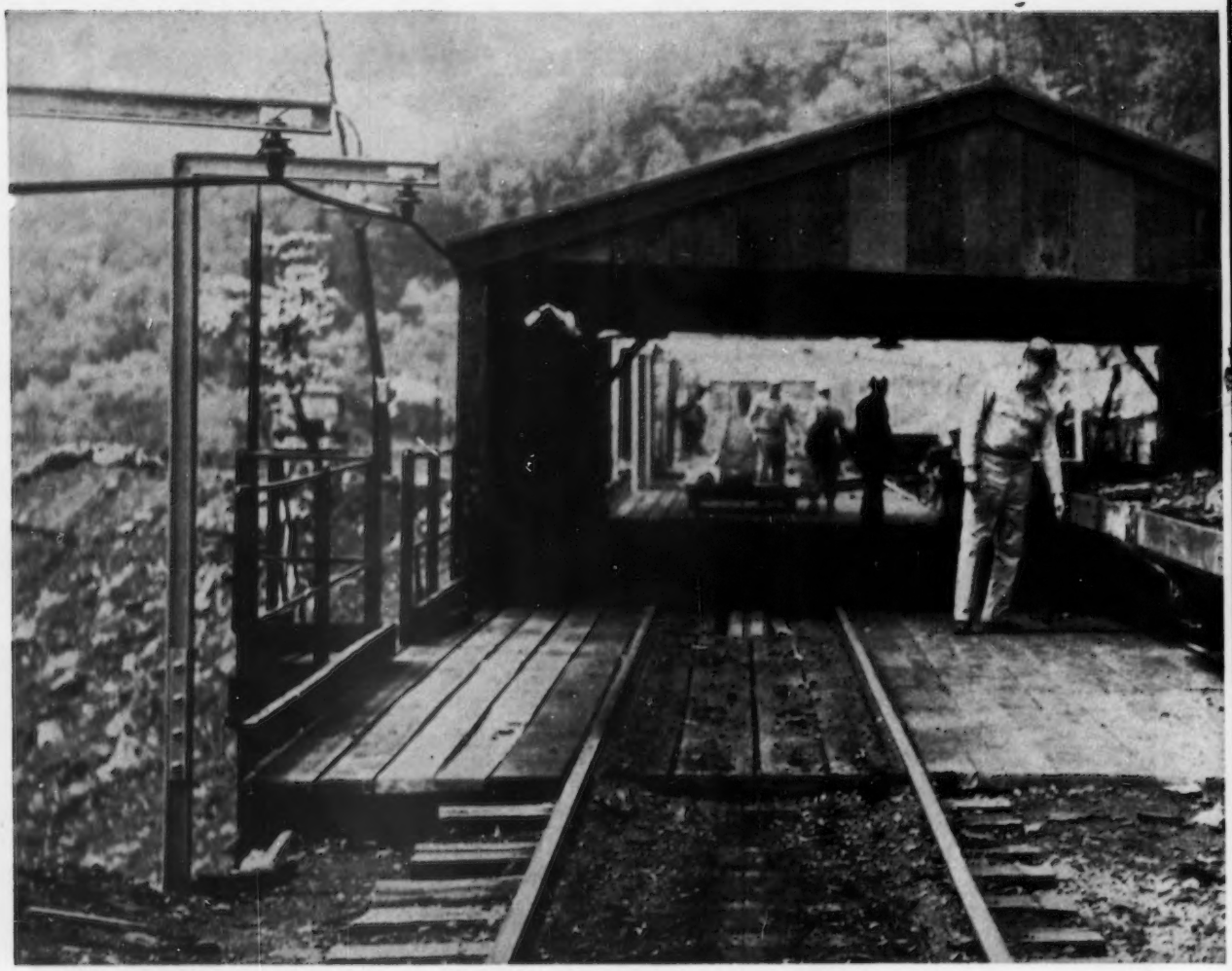
The equipment maker wanted a hose that wouldn't go to pieces in a few days from the pressure, oil and heat. His men talked it over with B. F. Goodrich and learned that engineers had developed a hose for just such jobs.

They found a way of reinforcing the hose with strong cords that stand over 5 times the pressure needed to shoot the flame—protecting the man who does the work. They developed a special rubber for the inside that stands oil without rotting or weakening.

The B. F. Goodrich hose that carries the oxygen, fuel oil, and cooling water to the jet pipe had been on the job *8 months* when the picture was taken, is still going strong.

This is an example of the ways B. F. Goodrich engineers find to make rubber save money for users—either by doing a job other rubber can't do, or by lasting longer, or by replacing other more expensive materials. Your B. F. Goodrich distributor would like to tell you what these improvements are, and how they can be employed for your profit. *The B. F. Goodrich Company, Dept. M-552, Akron 18, Ohio.*

B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION



How Sanford-Day proved Olympian Grease best for mine car wheels

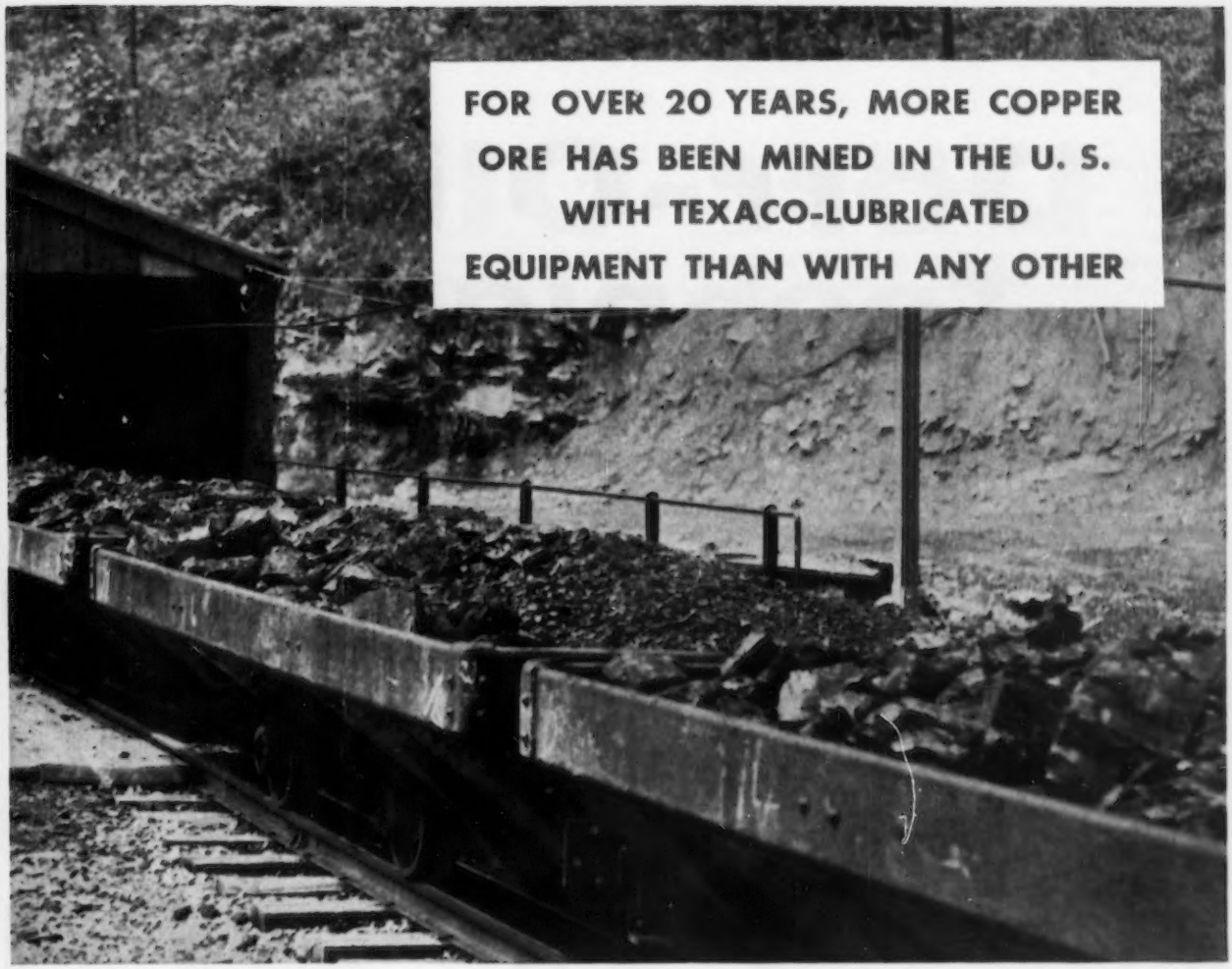
MINE CARS built by Sanford-Day Iron Works, Knoxville, Tennessee, are noted for their quality. Back in the late 1930's, Sanford-Day began equipping its car wheels with special floater-type ball bearings—and set out to find the grease that would give them the best and longest lasting protection.

Using a special test set-up that simulated the most adverse operating conditions, Sanford-Day com-

TUNE IN:
TEXACO STAR THEATER
starring
JIMMY DURANTE
on TV Saturday nights.
METROPOLITAN OPERA
radio broadcasts
Saturday afternoons.

TEXACO

TEXACO



pared *Texaco Olympian Grease* with well-known competitive greases—including two they had been using regularly.

Texaco Olympian Grease clearly outperformed all competitive products in resistance to water-wash and leaking, prevention of wear, easy starting at low temperatures, load carrying capacity and uniform consistency over longer periods of use.

That is why, for over 15 years, all bearings on Sanford-Day cars have been factory-filled with *Texaco Olympian Grease* and why Sanford-Day recommends *Texaco Olympian Grease* for continued use in service.

Whatever the make of mine car or the type of wheel bearing—plain, cavity hub or anti-friction—you assure better lubrication and lower maintenance cost by using *Texaco Olympian Grease.* It is available in three consistencies to meet every requirement.

A Texaco Lubrication Engineer will gladly give you full details. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

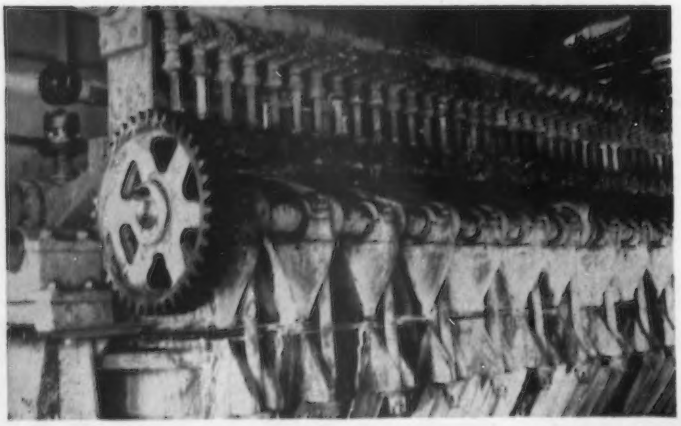
Lubricants and Fuels
FOR THE MINING INDUSTRY

Dorr-Oliver Techniques

AT

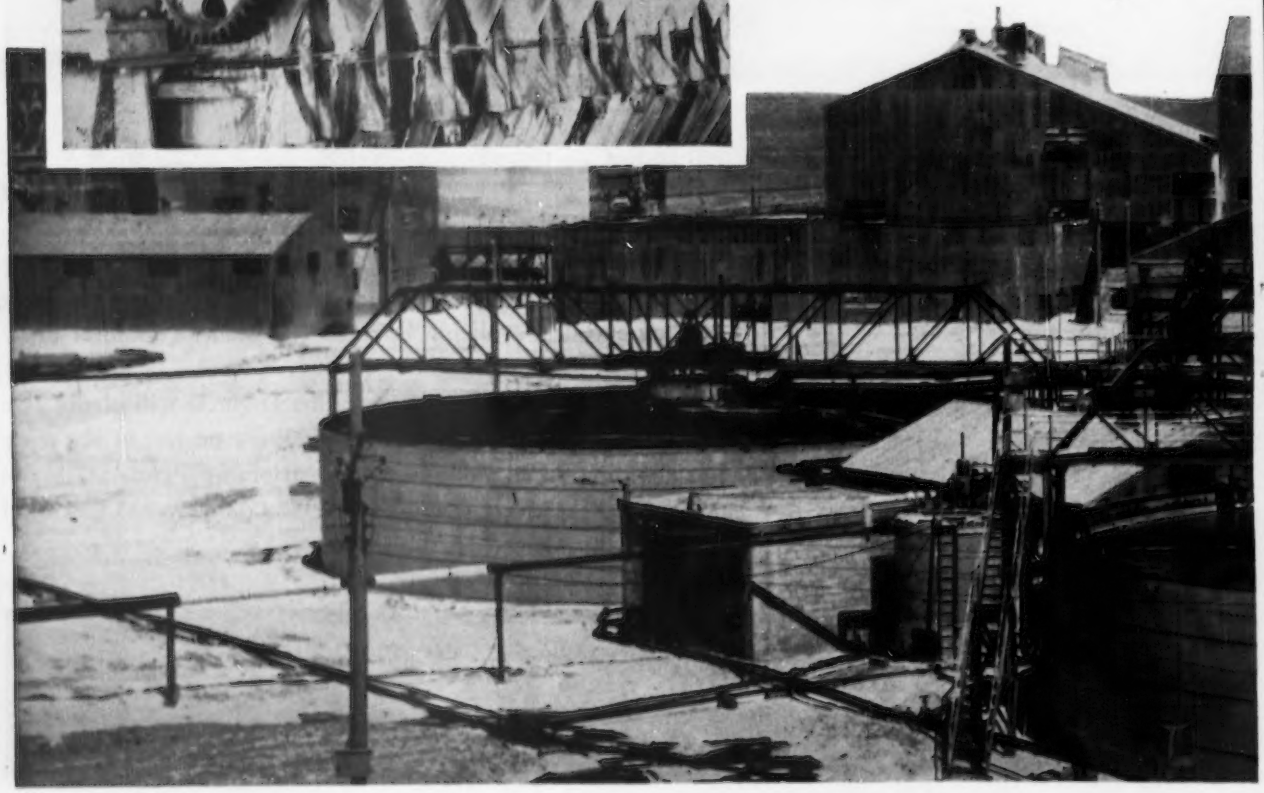
INTERMOUNTAIN CHEMICAL COMPANY...

(OPERATED BY WESTVACO CHLOR-ALKALI DIVISION, FOOD MACHINERY & CHEMICAL CORPORATION)



Closeup of one of the six Sweetland Filters.

General view of plant with three Dorr Thickeners in foreground.



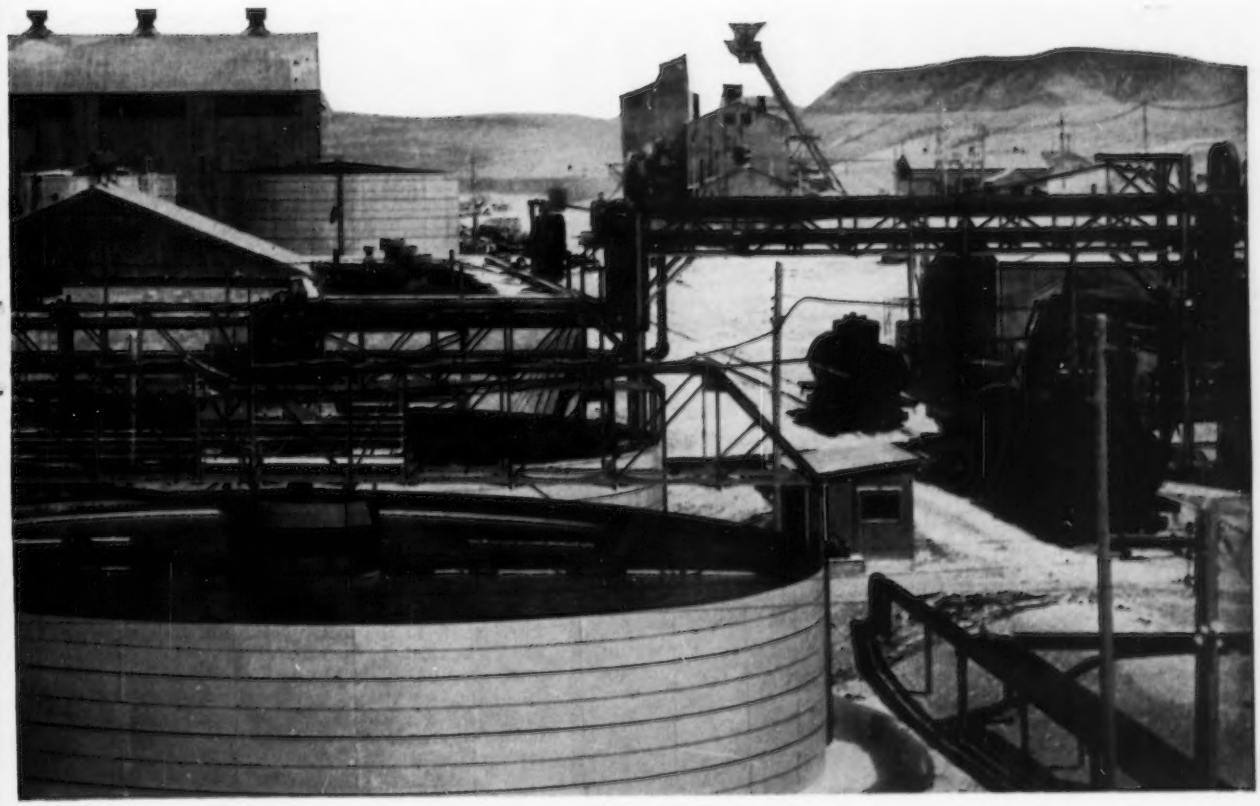
The vast trona deposits throughout the Green River, Wyoming, area represent an assured supply of soda ash for expanding western industry. But before calcination, insolubles amounting to approximately 10% must be removed by physical means. And here Dorr-Oliver equipment and methods play a vital role.

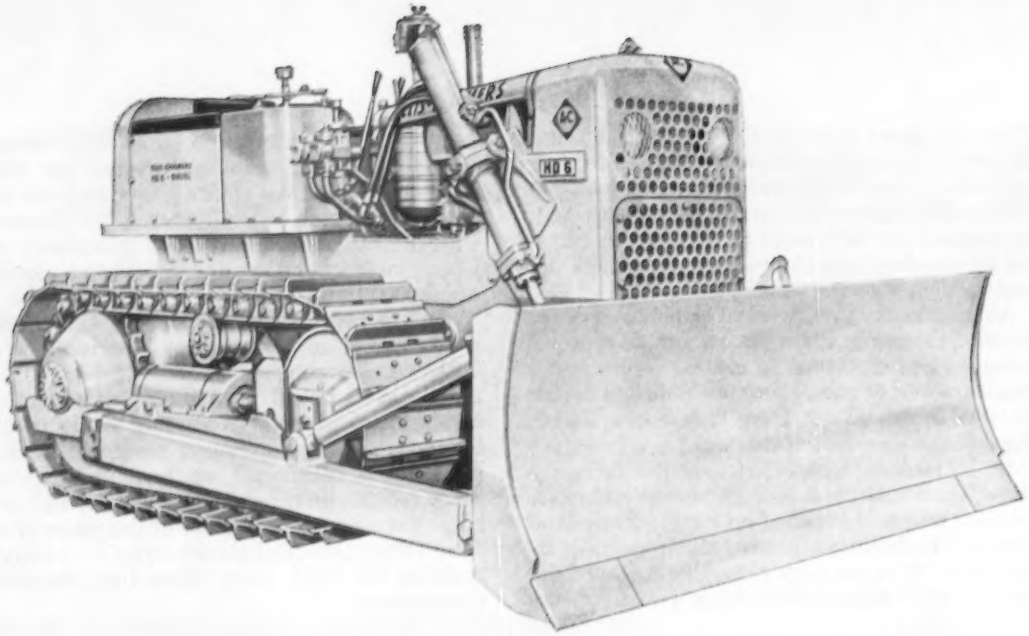
At Intermountain Chemical Company's Green River Processing Plant, trona ore is crushed, screened and dissolved in mother liquor and a small amount of makeup water. Solution is then clarified in two 80′ dia. Dorr Thickeners. Underflows are washed free of entrained salt in a third Dorr Thickener. Combined overflow from the three Thickeners is a sodium sesqui-carbonate solution which is polished on six #12 Sweetland Filters. The Sweetlands are of cast iron construction with 72 leaves each providing a total filter area of 6024 square feet. After polishing, the solution is concentrated in triple effect vacuum crystallizers. The resulting crystals are thickened in two 30′ dia. Dorr Units and are then calcined to soda ash. Operated by Westvaco Chlor-Alkali Division of Food Machinery and Chemical Corporation, the plant has a capacity of 350,000 tons per year.

For the Process Industries, Dorr-Oliver offers a complete and integrated service. Well-designed equipment, as installed at Intermountain Chemical, is an important part of this service. But if your processing needs involve laboratory and pilot plant testing, flowsheet preparation, economic analysis or complete plant design and construction, we can also be of help. For a complete picture of the scope of the Dorr-Oliver technical service write for a copy of Bulletin No. 7003. Dorr-Oliver Inc., Stamford, Connecticut.

Sweetland — T.M. Reg. U. S. Patent Office

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

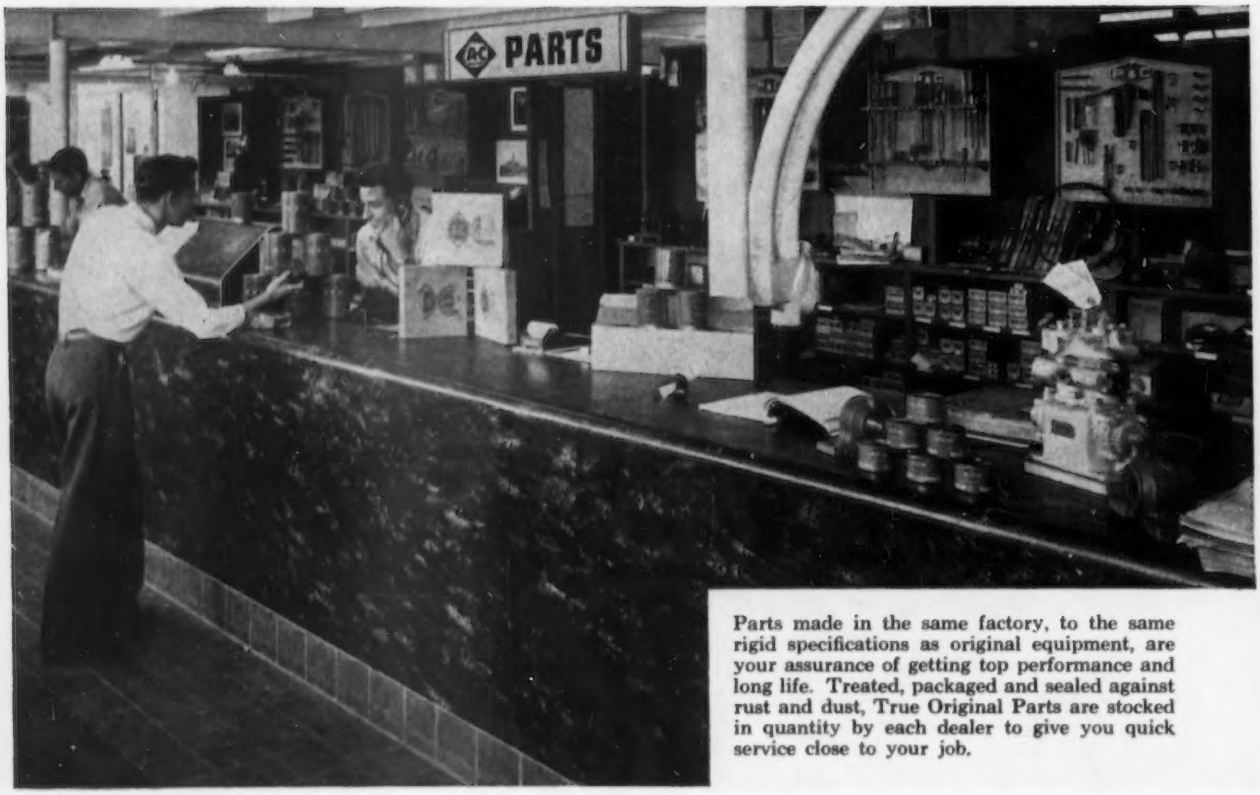




You're always sure of

TRUE ORIGINAL PARTS

from your Allis-Chalmers dealer



Parts made in the same factory, to the same rigid specifications as original equipment, are your assurance of getting top performance and long life. Treated, packaged and sealed against rust and dust, True Original Parts are stocked in quantity by each dealer to give you quick service close to your job.

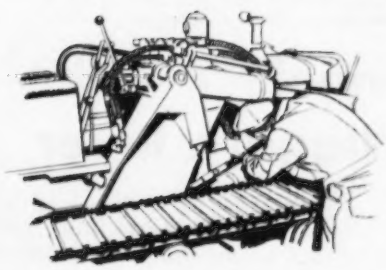
SOLD but not forgotten
by your Allis-Chalmers dealer

When you invest in Allis-Chalmers equipment, you are getting far more than just a modern machine. Your dealer offers you the opportunity to do a better job at lower cost. He wants your equipment to give A-1 performance day in and day out. His reputation depends on it.

That's why your Allis-Chalmers dealer puts so much importance on good preventive maintenance practices . . . encourages you to take full advantage of his modern servicing facilities.

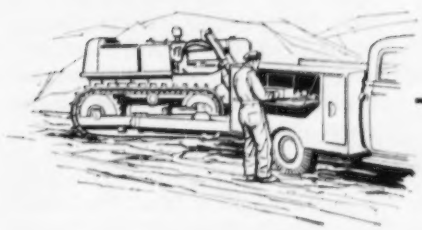
and you can have confidence in his

FACTORY-TRAINED MECHANICS, FACTORY-APPROVED METHODS



IN THE SHOP

Specialized facilities include factory-approved tools and all necessary equipment for complete service. Factory-approved methods are used to save you time and money, assure finest workmanship.

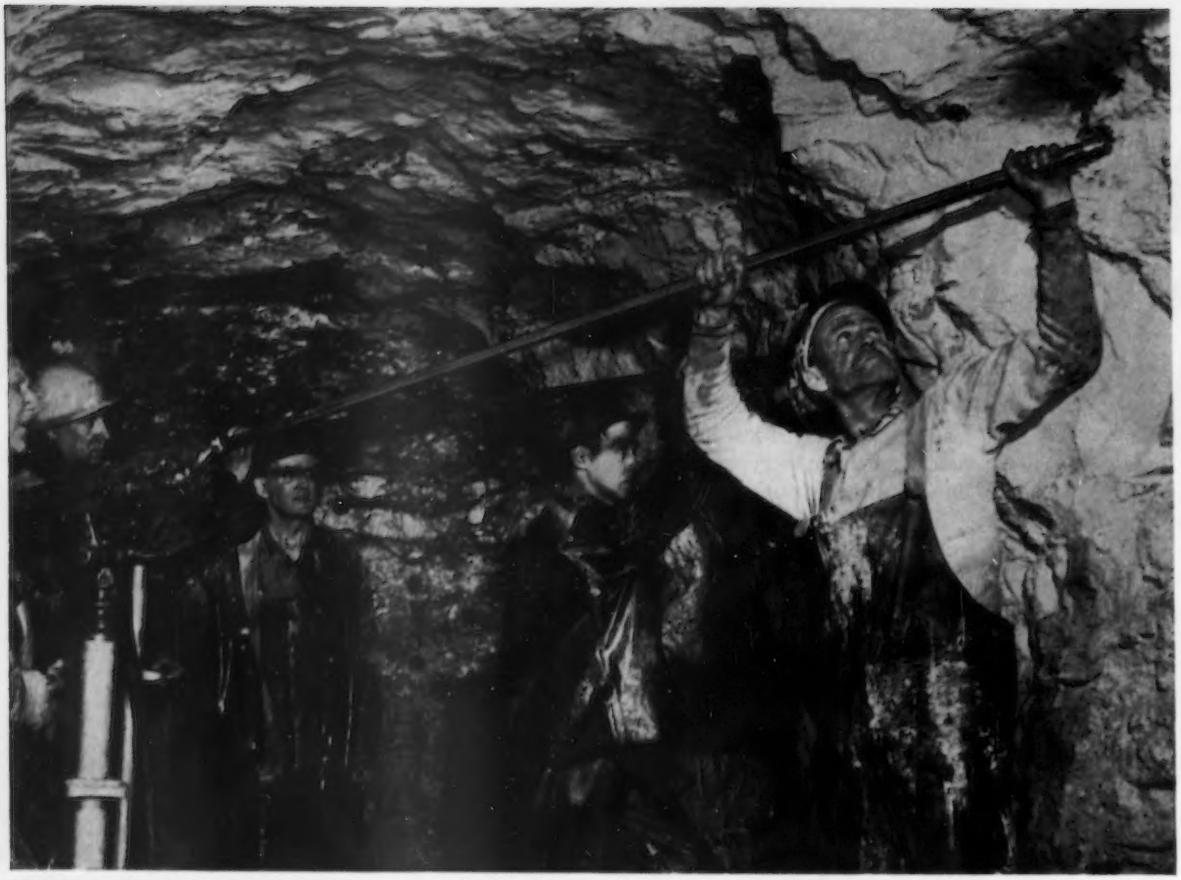


ON THE JOB

Factory-trained servicemen are ready to help you, day or night. Their technical know-how and practical experience get the job finished fast . . . at lowest possible cost to you.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS



Bethlehem Hollow Drill Steel gave good service as Tonawanda's water-intake tunnel was bored through solid rock beneath the Niagara River. *General Contractor:* Herbert F. Darling, Williamsville, N. Y.; *Consulting Engineers:* Nussbaumer, Clarke & Velzy, Inc., Buffalo, N. Y.

They Bored Water-Intake Tunnel Through Rock Beneath Niagara River

The Town of Tonawanda, N. Y., recently bored a water-intake tunnel, some 6,000 ft long, about 100 ft beneath the swirling waters of the Niagara River. The tunnel, 7 ft high and 7 ft wide, is part of Tonawanda's new municipal water system, and is expected to be in operation shortly.

Closeup of Bethlehem roof bolts, used in tunnel with square plates and longitudinal ties to prevent rock falls. These long bolts are driven deep for firm anchorage.

Construction of the tunnel called for the removal of 9,200 cu yd of rock, most of it medium-hard limestone. Using drills with air-leg mountings, and making exclusive use of 1-in. hexagon Hollow Drill Steel, fitted with carbide bits, the contractors drilled blast holes 6 ft deep. The total footage drilled for the tunnel was in the neighborhood of 130,000 lineal ft.

Wherever there's rock to be moved, you can count on satisfactory service from Bethlehem Hollow Drill Steel. This is because Bethlehem Hollow is rolled from a tough, fatigue-resisting steel. It has a wide quenching range. It's easy to heat-treat for the ideal balance of hardness and wear-resistance. It also makes long-wearing threads and tough shanks.

Bethlehem Hollow Drill comes in rounds, hexagons and quarter octagons, usually in lengths of 18 to 25 ft. Longer lengths can be furnished to meet special requirements. It's good, sound drill steel — and it can hold drilling costs to the minimum in any job you name!

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM HOLLOW DRILL STEEL

PROGRESS IN

delivered...by THERMOID

This Thermoid conveyor belt is handling bauxite at an unloading dock in Baton Rouge, La. It was selected for maximum flexibility and resistance to loading impact.

Whatever your materials handling job, there are Thermoid conveyor belts designed to meet your requirements. For example: Thermoid HT for extremely abrasive materials such as quartz ores, trap rock and coal... Thermoid A for highly abrasive materials: slag, lime rock, ore, ashes, hot cement and crushed stone... Thermoid C for moderate abrasives such as sand, loam and gravel.

Put belts like these to work on your conveyors. Get the long wearing advantages of Thermoid's exclusive impregnation process. It welds belt carcass and cover into a real brute for punishment! Thermoid's specially woven, finest quality reinforcement troughs easily—withstands shock loading like no ordinary belt can do.

Your Thermoid Distributor will be glad to help you select the conveyor belt that's right for your needs.

Thermoid makes many types of hose designed for specific mining applications. Quality construction saves hose dollars.

Maximum efficiency in power transmission is assured with long wearing matched sets of Thermoid Multi-V Belts.

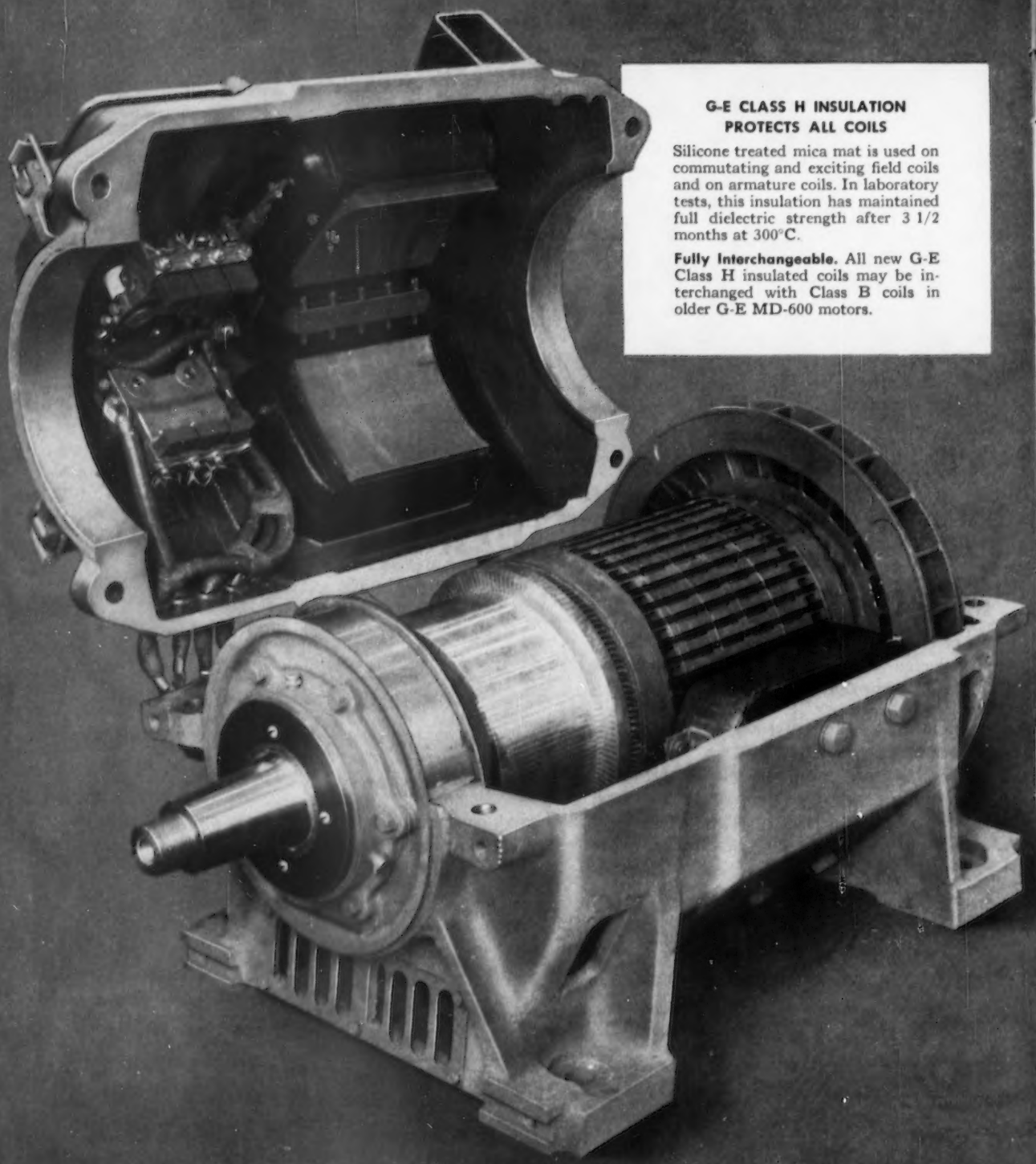
Thermoid

THERMOID COMPANY, Trenton, N.J.

PROGRESS IN
DIRECT-CURRENT DRIVES

NOW! Roastouts

NEW G-E MD-600 MOTORS



G-E CLASS H INSULATION PROTECTS ALL COILS

Silicone treated mica mat is used on commutating and exciting field coils and on armature coils. In laboratory tests, this insulation has maintained full dielectric strength after 3 1/2 months at 300°C.

Fully Interchangeable. All new G-E Class H insulated coils may be interchanged with Class B coils in older G-E MD-600 motors.

Virtually Eliminated on . . .

WITH CLASS H INSULATION

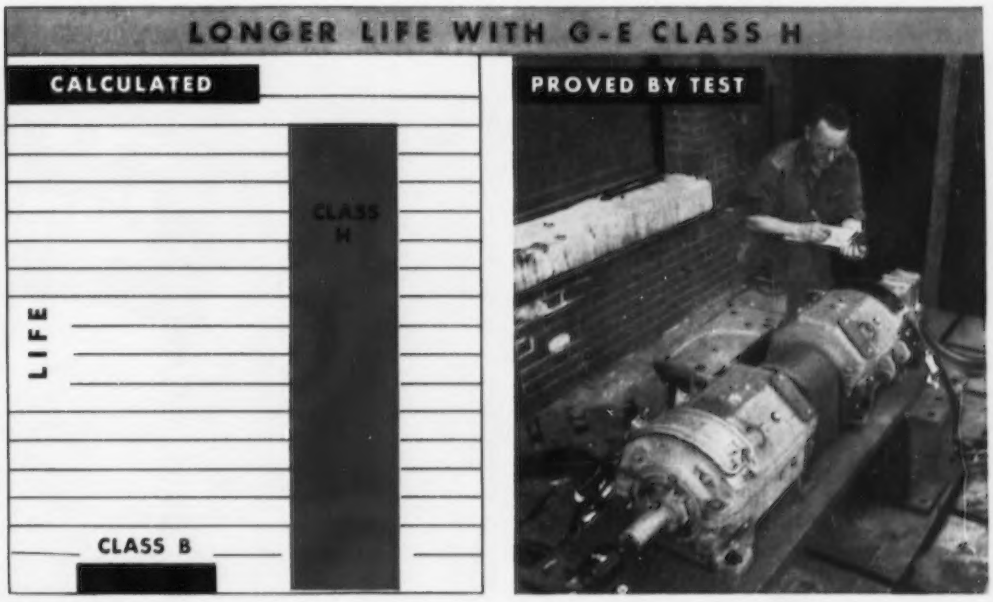
G.E. offers—in all MD-600's—Class H Insulated Coils

WHAT IS CLASS H? General Electric research has developed a combination of inorganic and silicone materials for a new insulation system now used in all MD-600 motors. These Class H materials will withstand temperatures up to 180°C continuously.

BETTER FOR HEAVY DUTY. Auxiliary mill motors often encounter unexpected high ambient temperatures, unforeseen extended duty or emergency conditions. Any one of these can cause "roastouts" from temperatures higher than the insulation capacity. The new G-E Class H insulation will resist up to 50°C more than Class B, resulting in longer motor service.

REWINDS ELIMINATED? On normal duty, insulation failure may be eliminated as the limiting factor in continuous armored motor service. Engineers calculate that each 10°C rise in temperature reduces the life of a given type of insulation by half. *Since G-E Class H will withstand 50°C higher than Class B, its life* **at the same temperature** *should be increased 2⁵ or 32 times!*

YOUR G-E SALES REPRESENTATIVE HAS COMPLETE INFORMATION. Contact him at your nearby G-E Apparatus Sales Office, or write Section 812-1, Direct Current Motor and Generator Department, General Electric Company, Erie, Pennsylvania.

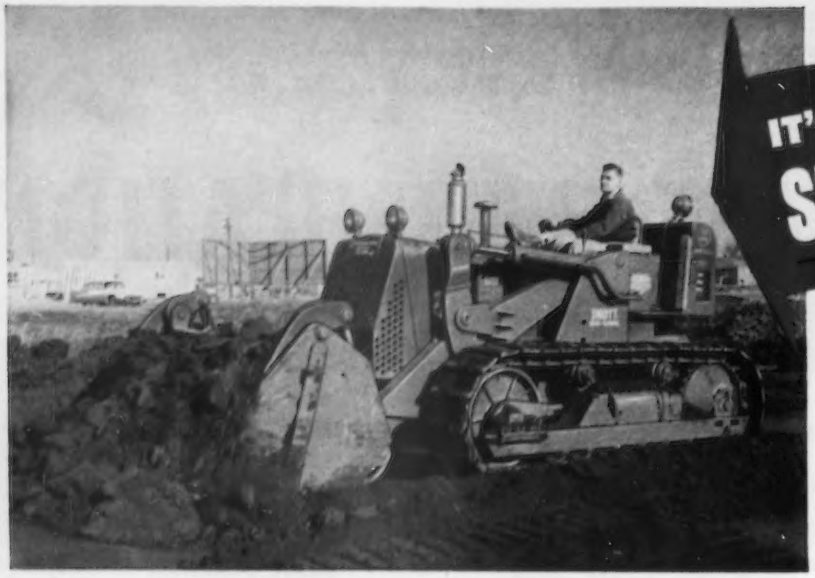


ENGINEERING STUDIES indicate that under identical operating conditions new G-E Class H insulated coils in MD-600 motors will last up to *32 times* as long as conventional Class B coils. Insulation failure may be eliminated as the limiting factor in continuous auxiliary mill motor service.

ACTUAL TEST with Class H and Class B motors coupled together *proves to date* the new insulation will last more than twice as long as the old. After burning out two Class B insulated motors, the one with Class H coils is still operating under exaggerated load, vibration and atmospheric conditions.

Progress Is Our Most Important Product

GENERAL ELECTRIC



IT'S A **Skid-Shovel**

with Drott's exclusive *triple-power*, pry-over-shoe break-out action—plus 42° ground-level bucket roll-back! The Skid-Shovel position also gives you speedy straight-forward loading—time-gaining, strain-saving Skid-Shoe load transport!

EXCLUSIVE NEW 2¼-YARD *gives you 4-machine utility ...*

IT'S A **Clamshell**

a "wide-opener" that gives you a speedy bucket-fill on stockpiled loose materials, even in cramped quarters. And as a clamshell, the Four-In-One gives you a 30-inch dumping height advantage over ordinary roll-forward bucket dumping.

Move the Four-In-One "machine-selector" lever with finger-tip ease, and prove *versatility unlimited* . . . get the job-range of a machinery yard full of costly, limited-duty rigs! Test the tremendous excavating power of exclusive pry-over-skid-shoe break-out action. Compare how exclusive shock-swallowing Hydro-Spring speeds production, protects performance. Try this big new 2¼-yard Four-In-One, or the TD-6 one-yard or TD-9 1½-yard model. Ask your nearby International Drott distributor for a demonstration!

IT'S A **Bullclam**

with famous Drott Bullclam Shovel efficiency on all Sanitary Landfill operations—*plus* unequalled ability to *strip, grade,* and *spread,* using clam lip control. And as a Bullclam, the Four-In-One can *self-load* like a carry-type scraper!

TD-14 FOUR-IN-ONE

for one moderate investment!

IT'S A **Bulldozer**

with clam open in bulldozing position, the big-capacity earth-rolling blade has cutting edge and shoes on the ground. You regulate depth of cut with ease and accuracy by hydraulic "radius control" of blade pitch (forward and backward).

International Harvester Company, Chicago 1, Illinois

INTERNATIONAL®

DROTT

for copper converter linings . .

These carefully controlled refractories are made from the best quality raw materials, are formed under high pressure and are fired extremely hard. They are used also with great benefit in longer life for parts of copper reverberatory smelting and refining furnaces.

In addition, Harbison-Walker produces all other classes of basic refractories for every metallurgical furnace need. MAGNEX and METALKASE brands have long established records of excellent service in suspended roofs.

HARBISON-WALKER provides Two service-proved basic refractories

• Chromex B

Briefly summarized, the desirable properties which account for the excellent service secured with this extra hard fired chrome-magnesite refractory are:—high density and impermeability—relatively low thermal expansion and good resistance to thermal shock—unusual stability and high strength at high temperatures.

• H-W Magnesite

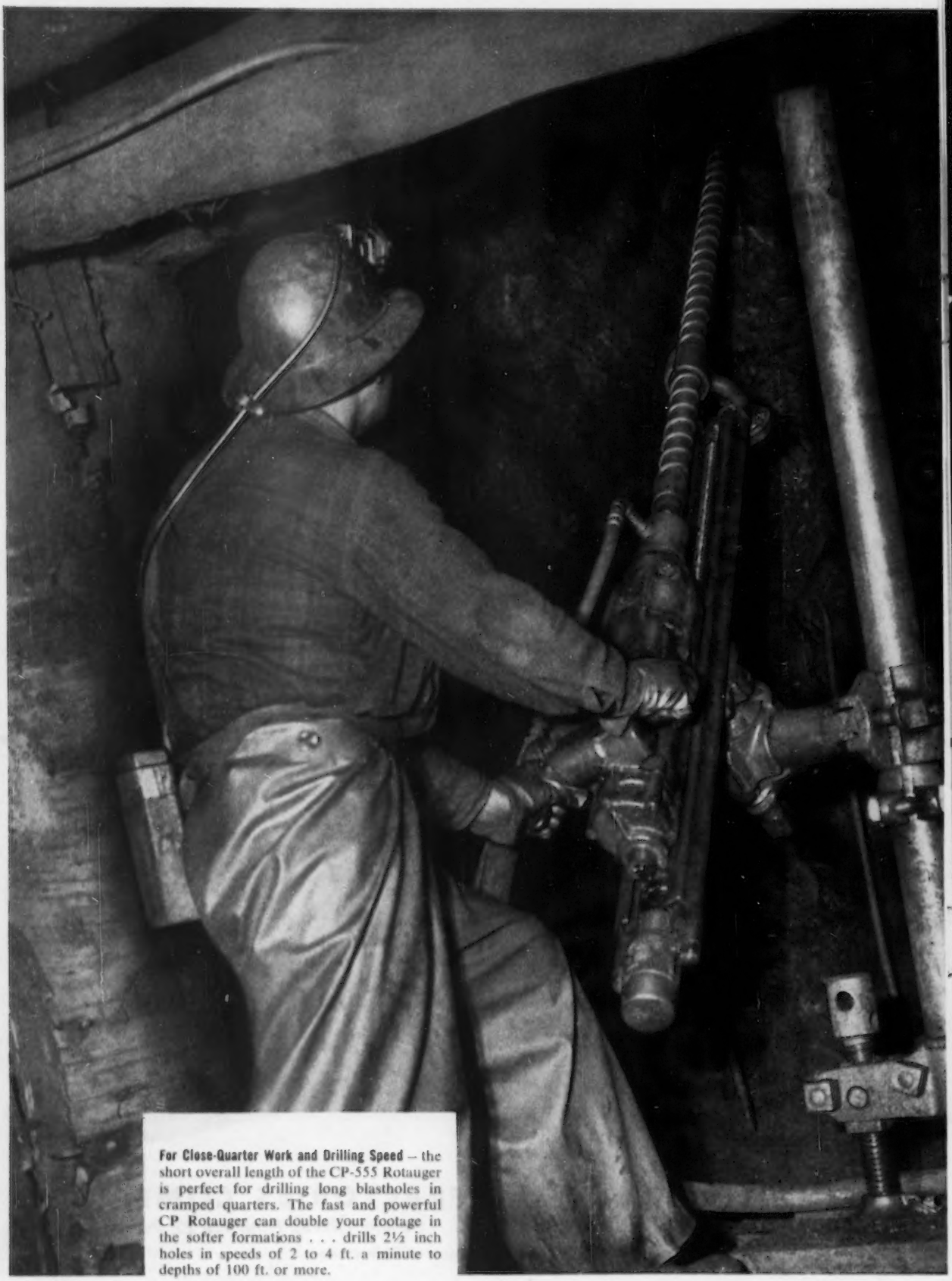
For the most strongly basic linings this refractory, consisting predominantly of periclase (stabilized crystalline magnesia), fulfills the most severe requirements. It is fired at an extremely high temperature and is dense, strong and volume stable at temperatures far above the highest employed in copper converters.

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES

General Offices: Pittsburgh 22, Pennsylvania

World's Largest Producer of Refractories



For Close-Quarter Work and Drilling Speed – the short overall length of the CP-555 Rotauger is perfect for drilling long blastholes in cramped quarters. The fast and powerful CP Rotauger can double your footage in the softer formations . . . drills 2½ inch holes in speeds of 2 to 4 ft. a minute to depths of 100 ft. or more.

There's a CP drill for every mining need!

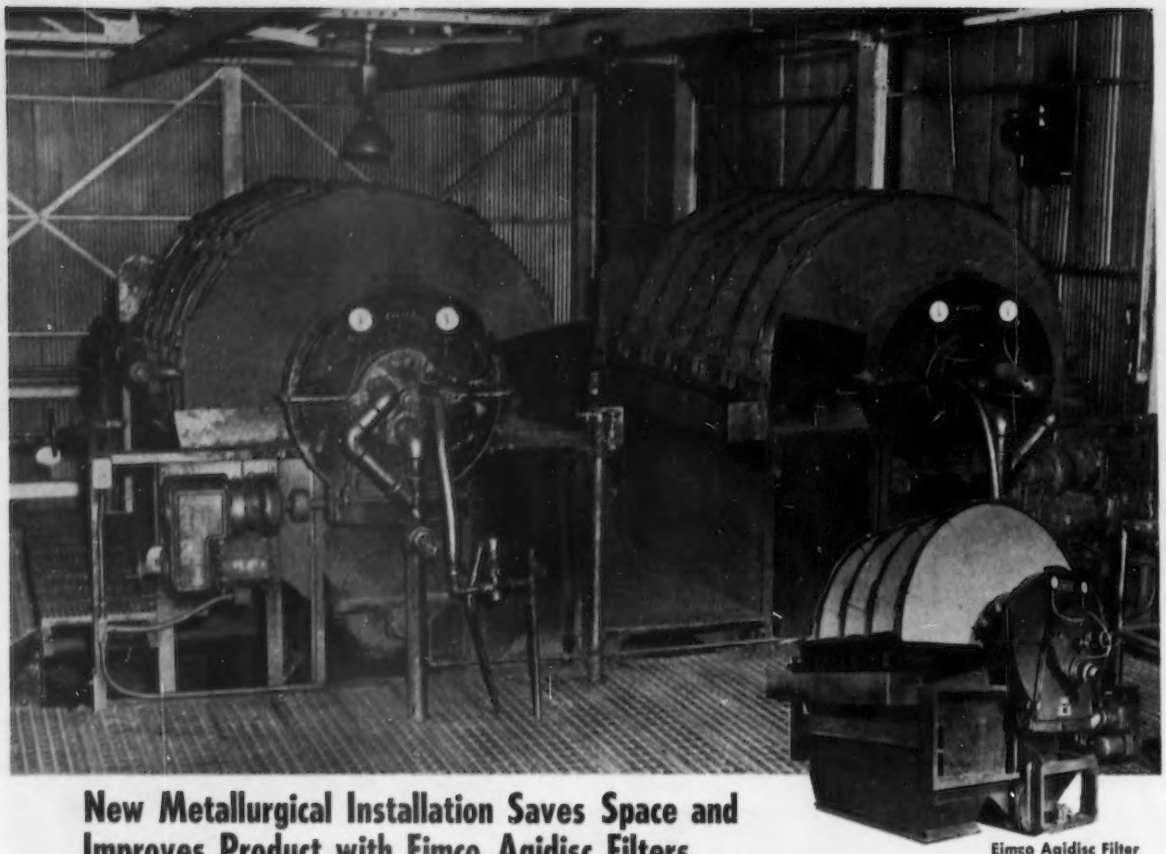
For Complete Versatility – CP Integral and Attachable Air-legs teamed up with Chicago Pneumatic Sinkers get the most out of tungsten-carbide bits. The Attachable type is ideal for mounting standard sinkers for intermittent or production drilling; the Integral type is designed primarily for production drilling . . . both models in standard feeds of 36″ and 48″.

For Blast Hole and Exploratory Drilling – the powerful, lightweight, easy-to-handle CP-55 Diamond Core Drill is faster than any other diamond drill in its class. Has a highly efficient CP Rotary Air Motor . . . requires a minimum of air per foot drilled. Conservatively rated at 500 feet with E Rods and EX Fittings. Skid mounted types are available for test borings . . . rated in capacities to 2250 ft.

For Stoping and Raising – the CP-34 Stoper has just-the-right combination of piston speed, foot-pound blow, rotating speed and feed-leg pressure to achieve that extra long service and performance from tungsten-carbide bits.

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



Eimco Agidisc Filter

New Metallurgical Installation Saves Space and Improves Product with Eimco Agidisc Filters

The photo above shows an installation of two 6′ diameter by 5 disc Eimco Agidisc Filters in their operating position in a new metallurgical concentrating plant.

These filters were installed as a result of the owner company and Eimco cooperation in a joint effort to improve the operation of the filter station at this plant and reduce moistures with the most economical equipment.

After the installation had been operating for six months the following data was made available.

	PREVIOUS EQUIPMENT	NEW EIMCO FILTERS
1. Concentrate handled	350,000 lbs./24 hrs.	350,000 lbs./24 hrs.
2. Labor required	1 man full time	1 man part time
3. Attention required	Constant inspection	Periodical inspection every 6-8 hrs.
4. Operating Capacity	Full load—no capacity for additional tonnage	½-¾ load—capacity for 33% to 100% additional tonnage
5. Equipment	4—Drum filters (not Eimco)	2—6′ dia. x 5 disc Eimco Agidiscs
6. Filter area	621 sq. ft.	500 sq. ft.
7. Floor Space occupied	416 sq. ft. filters only	189 sq. ft. filters only
8. Cake Moisture	20%—21%	14%—15%
9. % Moisture reduction over previous method		33%
10. Filter rate increase over previous method		more than 15%

Eimco specializes in equipment to do a better job in filtration. Before you buy, take advantage of Eimco's experience in building filtration equipment for customers who look beyond first cost to get quality construction, individual design and guaranteed performance.

B-102

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Texas Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Pasadena, Calif. Houston, Texas London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

PAN

CONTINUOUS PRESSURE

PRESSURE PRECOAT

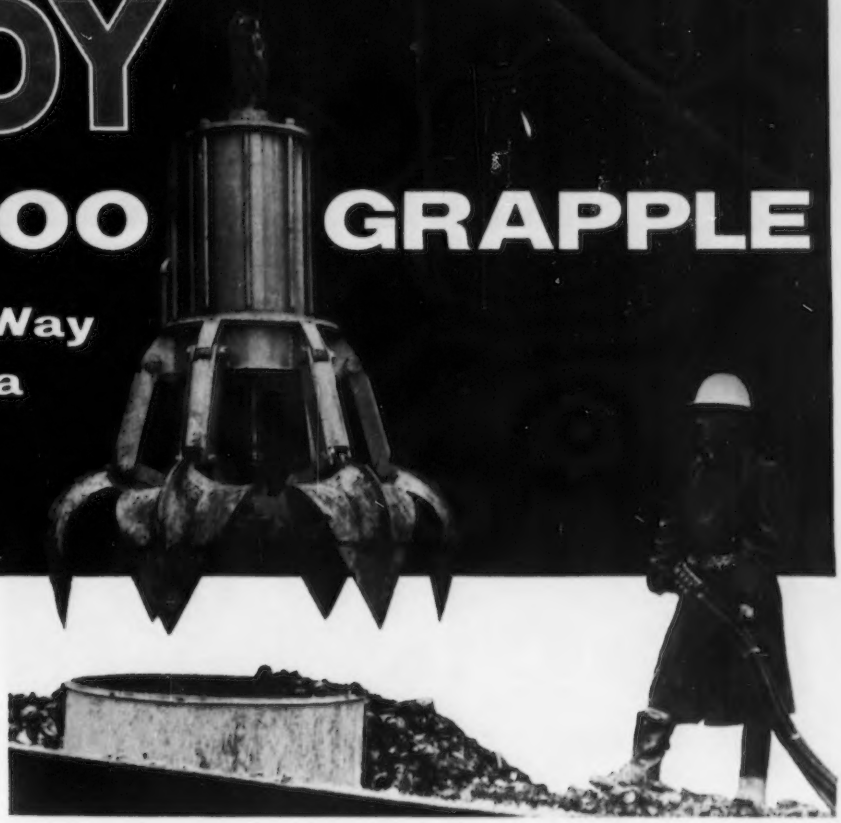
BI-CARB

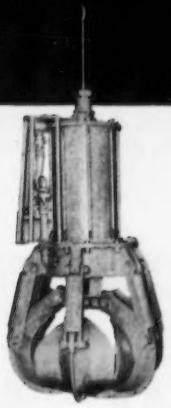
PRESSURE ROLL

BURWELL

The JOY JPG-100 GRAPPLE

Efficient Way to Muck a Shaft





The complete Joy Shaft Mucker consists of the JPG-100 Grapple, operating boom, steel base, hydraulic cylinders and lines, air-operated hydraulic pump, air-operated hoist and remote control system—plus the services of a Joy demonstrator-operator on the job to help install equipment and train your men.

In shaft sinking, the Joy JPG-100 Grapple, with a 4/10 cubic yard capacity, will outperform a 7/10-yard air-operated clamshell under almost any condition. This has been demonstrated repeatedly on sinking jobs where the Joy Grapple has replaced such a clamshell. Here's why—

While taking a smaller load than the clamshell, the Grapple loads faster, opens and closes faster, and takes a full load on every bite.

The Joy Grapple consists of six orange-peel-like tines which are opened and closed by a powerful pneumatic cylinder. Its outstanding digging action results from a combination of weight and strong closing action. Operation is controlled from a push-button control panel (eight buttons) which is held by the operator at the bottom of the shaft where he can clearly see the complete operation. Push-buttons open, close, raise, lower, and swing the Grapple in four directions.

For more information about the efficient Joy JPG-100 Grapple and the complete Joy Shaft Mucker, write **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 59-4

WSW M5976-59

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

Consult a Joy Engineer

for AIR COMPRESSORS, ROCK DRILLS, CORE DRILLS, HOISTS and SLUSHERS, MINE FANS and BLOWERS

A PICTURE REPORT OF

INTERNATIONAL POWER

Boosting job production everywhere

"Tops for stripping overburden," reports Maurice Stein, Superintendent for Elliot Coal Mining Company, Philipsburg, Pennsylvania, of his company's TD-24's. "We've used two for three years now . . . find they give maximum output with very low maintenance. Our operators especially like their ease of handling and good balance. We also like their planetary steering system which lets our operator safely work on steeper terrain." Right now, rigs are removing 40 ft of shale and clay to uncover a 24-inch vein of "C" seam bituminous coal.

For utility work around pit or plant, 39½ dhp International 300 can be equipped to do most any task. Here, rig loads and unloads trucks. With other attachments, "300" plows snow, blades roads, loads bulk materials, digs ditches, mows grass, tows trailers. Rig has 10 speeds forward to 16.7 mph, develops 4,379 lbs pull.

Fast on job, fast between jobs—Handling all tractor work in a quarry near Denver, Colorado, 200 hp TD-24 saves time by driving from job-to-job at 7.8 mph. Output, 2200 tons of 1¼-inch stone per 8-hour shift, is taken from crusher by International-powered belt conveyor, background, then stockpiled by TD-24. Unit also does all stripping.

"Ideal for dozing rock," says Paul Weaver Supt for Joe Wenke Quarries of this veteran TD-14A. "We use it continuously for shovel and quarry-floor cleanup. Performance has been excellent. Downtime is way down due partly to rugged construction, partly to prompt parts delivery and service from our International distributor." Quarry, located at Toledo, Iowa, produces 200 tons of 1-inch road stone per hour.

3000-ft cycle every 3 min is the record of Western Construction Co.'s "55" Payscraper. This includes time for TD-24 to push-load 10 bank yds of ripped caliche. Payscraper's fast-loading ability makes it ideal for stripping overburden . . . high ratio of horsepower to loaded weight, oversize air brakes speed hauls up and down steep grades. Photo was taken near El Paso, Texas.

Loader does job too tough for shovel—In an assignment which dramatically illustrates the tremendous break-out International Drott can bring to bank-loading, Al Pangia's TD-14 rips up a 150-yd concrete filling station driveway in Camden, N. J. Engineers say a ¾-yd shovel could not have done the work . . . yet TD-14 broke and loaded the slab unassisted.

International

makes every load a pay load

INTERNATIONAL HARVESTER

Industrial Power

A machine size for every job . . . see your nearest INTERNATIONAL DISTRIBUTOR for details.

PAYSCRAPERS
13 yds. and 18½ yds.

CRAWLER TRACTORS
4 Models . . . 40 to 200 hp

DIESEL, GAS ENGINES
10 Models, 16½ to 200 hp

WHEEL TRACTORS
3 Models . . . 9 to 50 drawbar hp

ALSO: International Drott Loaders . . . International Scrapers, Bottom-Dump Wagons . . . and International Superior Pipe-Laying Tractors

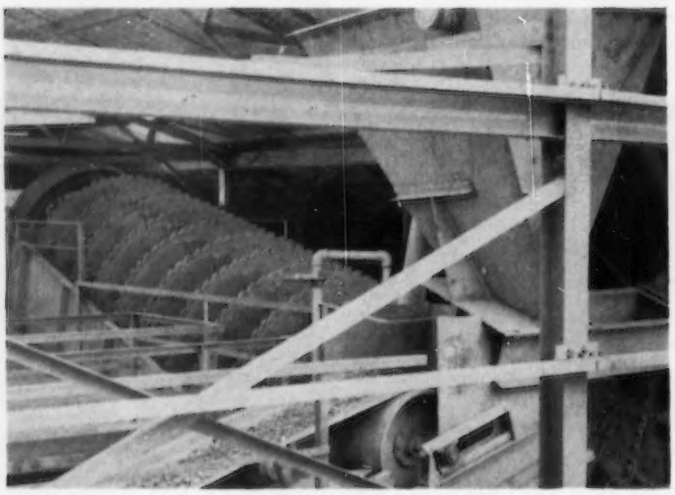
AKINS 1st in EXPERIENCE with Spiral Separators for Heavy Media

1908 . . . the first Akins. Colorado Iron Works made the first Akins Spiral Classifier in 1908. Its outstanding success led to many profitable applications and to Akins' leadership in the field of classification.

1938 . . . Heavy Media. Experimentation on the use of Akins Spiral Classifiers in making a sink and float separation was first started in 1938. Continuous research, on pilot plant and commercial scales, resulted in development of the Akins Separator . . . a modification of the classifier which retains all of the important mechanical features of the Akins. In 1944 the first 78" Akins Separator was placed in successful operation by one of the large iron mining companies.

. . . 1956

This 84" Akins Separator, installed in 1952, is typical of the many successful installations on iron ore. This unit's performance during its first year of operation resulted in the company purchasing a duplicate Separator for another of its plants. These Separators are achieving outstanding results, improving both grade and recovery through extraction of middlings . . . **taking advantage of Akins' exclusive ability to make a 3-product separation in one machine, requiring only one media circuit.**



Proved Facts about AKINS SEPARATORS

• 3-product separation in one machine, requiring only one media circuit. • Start-up under full load. • Entire vessel is visible and accessible. • Variation in rate or grade of feed is not detrimental. • Large pool area and volume minimize tramp refuse in the product and facilitate better recovery of values from fine sizes. • Gradation of gravity and viscosity from feed entry point to sink removal point provides natural cleaning of sink, and allows circulation of media at lower gravity and viscosity.

YOU can have the advantage of this AKINS EXPERIENCE just write, wire or call . . .

Akins—the ORIGINAL spiral type classifier.

COLORADO IRON WORKS CO.

1624 17th Street • Denver 2, Colorado

AKINS CLASSIFIERS • SKINNER ROASTERS • LOWDEN DRYERS

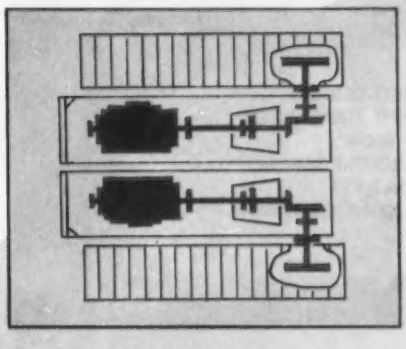
Sales Agents and Licensed Manufacturers in Foreign Countries

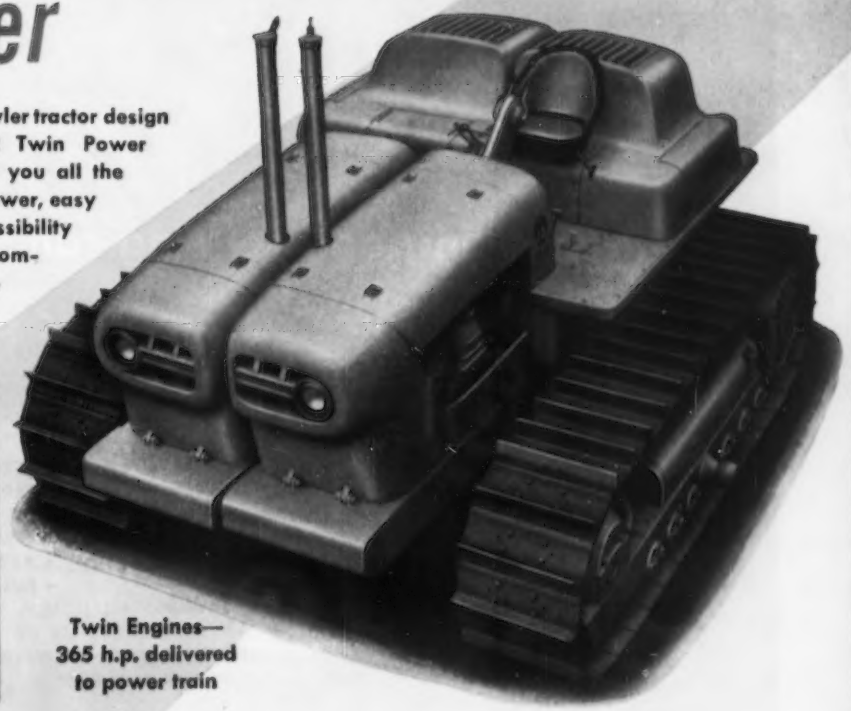
A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.

Biggest Tractor News in Years...

the "Euc" TC-12 Twin Crawler

Here's a completely new concept of crawler tractor design and performance . . . the new TC-12 Twin Power Euclid. It's designed and built to give you all the features you want in a tractor—more power, easy operation, greater workability and accessibility for servicing . . . and all power train components are matched, with years of application in earth moving equipment.





Twin Engines—365 h.p. delivered to power train

SPECIFICATIONS

total h.p.—388 h.p. at rated speed	
available for tractive effort—365 h.p.	
speeds—3 speed ranges forward and reverse to 8.3 mph	
drawbar pull (bare tractor)—forward and reverse	54,000 lbs. low range 53,500 lbs. intermediate 53,000 lbs. high range
track width (standard shoe)	26″
track gauge	110″
overall width	11′ 4″
overall length	16′ 2″
height (excluding stacks)	7′ 11″
drawbar height	23″
ground clearance	20″
operating weight (bare)	approx. 58,000 lbs.

Powered by two diesels with separate Torqmatic Drives for each track, the TC-12 has 365 h.p. available for tractive effort—a smooth steady flow of power to meet any job requirement. There's no master clutch and no manual gear shifting . . . the operator simply moves a lever to select one of three speed ranges—forward and reverse—for travel speeds up to 8.3 m.p.h. Maximum drawbar pull is equal to, or greater than, the weight of the tractor and any attachments.

Each half of the tractor is separate and free to oscillate on a single transverse shaft. This gives the TC-12 maximum stability and traction on rough ground. The tractor can be easily separated into two halves for shipment when necessary.

Never before so much workability!

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

GM GENERAL MOTORS

LECTROMELT* FURNACES

for smelting and refining range from 50 to 24,000 KVA for electrothermic production of...

- COPPER MATTE
- NICKEL MATTE
- TIN
- TUNGSTEN
- VANADIUM
- COBALT
- LEAD
- SILICON
- ZINC
- TITANIFEROUS AND NICKEL-BEARING IRON ORE
- CALCIUM CARBIDE
- PHOSPHOROUS
- FERRO-SILICON
- FERRO MANGANESE
- PIG IRON
- FERRO-CHROMIUM
- ABRASIVES
- FUSED REFRACTORIES

LECTROMELT engineers have been conducting continuing research for years on electrothermic reductions—have designed and built many furnaces for various branches of the metallurgical and chemical industries. They can advise you on many of those operations.

Lectromelt furnace components are strong and sturdy—electrode clamps and controls are positive and fast acting, but micro-accurate—charging methods are developed to a high degree—electrical equipment and substations are built to withstand tremendous overloads.

Catalog No. 105 describes Lectromelt equipment. For a copy, write Pittsburgh Lectromelt Furnace Corporation, 322 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in...GERMANY: Friedrich Kocks GMBH, Dusseldorf...ENGLAND: Birlec, Ltd., Birmingham ...FRANCE: Stein et Roubaix, Paris...BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege...SPAIN: General Electrica Espanola, Bilbao...ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

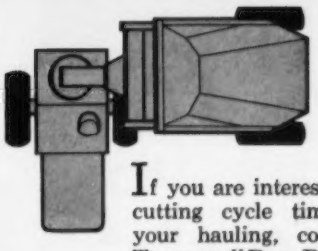
*REG. T. M. U. S. PAT. OFF

WHEN YOU MELT... MOORE RAPID *Lectromelt*

90° turns . . .

give faster cycles and easier spotting

Tournapull Rear-Dump's short-turn radius saved construction of expensive turn-arounds in this 26' wide, 165' deep railroad cut. With body raised, as shown, "C" easily made non-stop U-turns within the narrow area.



If you are interested in cutting cycle time on your hauling, consider Tournapull Rear-Dumps.

These units make a non-stop U-turn by power steer in less than their own length. They eliminate time normally wasted shuttling back and forth to turn in narrow quarters. They also frequently eliminate skid-plates or expense involved in construction of special turn-around areas.

Where space is unlimited, 90° turnability still gives you faster cycles. At the shovel, fast-maneuvering Tournapull Rear-Dump swings in and positions quickly. Loading unit need not sit idle while hauler operator wastes time on a wide sweeping turn and then a long, slow back-in. Quick, safe spotting saves additional time on the dump.

Simplicity reduces maintenance

A great deal of the expense involved in maintenance is also eliminated because of the simplicity of the Tournapull turn mechanism. Steering involves only an electric motor connected to a ring gear and king-pin shaft. A flick of the finger activates the motor and causes prime-mover to pivot up to 90° around trailing unit. Turns are made quickly regardless of footing. There are no front steering knuckles, no reach rods, no complicated mechanisms to get out of line, maintain, or repair.

Check these and all the other advantages of Tournapull Rear-Dumps. See for yourself how they speed cycles and cut costs. Write or call any time for owner-verified production studies and specifications. There's no obligation.

Model	Capacity	HP	Overall Length	Width req'd, non-stop 180° turn	
				Travel position	Dump position
D	11 tons	138	25'2"	24'8"	19'2"
C	22 tons	208	30'	28'8"	20'8"
B	35 tons	293	37'3"	35'	27'

These features, too, can help on your job

Hauls anywhere — Big single low-pressure tires let Rear-Dumps safely travel narrow haul roads, paved highways, city streets . . . haul cross-country over roughest terrain, through muck and soft fills.

Reduces maintenance — Because these Rear-Dumps have no jack lines, no long drive-shaft, no frame, sub-frame, springs or tie rods, most common troubles of conventional rear-dump haulers are eliminated.

Dumps fast, clean — Flick of switch activates hoist motor. Body lifts quickly to any desired angle for spreading on run. At full dump position, bowl-lip is behind rear wheels so dump can be made clean over bank. Streamlined body sheds material readily.

Cuts weather delays — Power-transfer differential automatically applies power to drive wheel on firmest footing . . . pulls unit through mud, sand, soft materials which stop ordinary haulers. It's a Tournapull exclusive.

Resists body shock, damage — Three-layer, all-steel, grid-type bowl with tool-steel floor resists loading shocks. Big, wide bowl opening is easy target for any loading unit.

Improves safety — Multi-disc air brakes have more braking surface on one wheel than most haulers have on all 4. Low center of gravity, good visibility, front-wheel drive, easy control all contribute to maximum safety.

Delivers full power — Torque converter (optional in C size) automatically balances load and torque so you get full horsepower always. Lugging is reduced; shocks in transmission and final drive virtually eliminated.

Reduces fatigue — Big low-pressure tires and air-foam cushion seat smooth out ride for operator. Electric push-buttons control power steer and 2-way power dump. Eliminated is all manual work of fighting balky levers.

Insures future earnings — Behind Tournapull prime-mover, you can interchange rear-dump with scraper, bottom-dump, crane, flatbed. These trailing units lower your investment, let you handle any future job efficiently, help you keep your Tournapull profitably busy the year-around.

Tournapull—Trademark Reg. U.S. Pat. Off. R-792-G-b

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

Photo courtesy American Zinc Co. of Tennessee

This Simplex-TIREX Cable carries 250-volt D.C. power to a 25-horsepower slusher hoist 800 feet from the main power line. The cable runs from pillar to pillar and is supported every fifty feet by a cane-shaped hanger wedged into the pillar.

The scraping of many hundreds of tons of ore per day rests upon the consistently satisfactory performance of this lone cable. Here is an operation where "cost cutting" by buying cheap cable simply cannot result in profit. Dependable day-in, day-out operation are primary requisites. Profits rest on it.

Simplex-TIREX Portable Cables are quality cables. They are engineered and manufactured to meet the toughest, most difficult operations that mining affords. They will withstand the blows of falling ore, spalling rock, etc. TIREX Cables were first made more than 35 years ago to meet and overcome the problems peculiar to mining. That's why you will find TIREX wherever you find mining.

Simplex-TIREX Cords and Cables are cured in lead to give you longer service. They are the only cord or cable that have the famous Selenium Neoprene Armor. When you next need a portable cable for slusher hoists, for loading operations, for electric locomotives, or for any other mining service, be sure that you specify and then insist that you get Simplex-TIREX Portable Cables.

Simplex

TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

240-acre pit

proves rubber-tired tractor ideal for scattered work

Unit's 19 mph speeds cut wasted travel time by over 50%

▲ Multi-disc air brakes totaling 2822 sq. in. braking surface give operator confidence to work fast close to edge of dump.

▲ Instant-shift, plus 8 mph reverse, enables tractor to clean around shovel without delaying load cycles.

Stone does little damage to tires . . . tires do ▼ no damage to tracks or pavement.

Five major tractor assignments face Columbia Quarry Company at their 240-acre limestone quarry near Columbia, Illinois.

1. Clean-up around a 6-yard production shovel (which loads 1,250,000 tons of rock yearly) . . .
2. Clean-up around two 3½-yard overburden stripping shovels . . .
3. Maintaining an overburden dump . . .
4. Maintaining a waste-rock dump . . . and
5. Maintaining at least 2 of the company's 15 crushed stone stockpiles each day.

These jobs, located from ½ to 1 mile apart, are handled efficiently with only *one* tractor — a high-speed Tournatractor!

This big 208 hp rubber-tired unit drives *everywhere under its own power* — on job-to-job moves, it often reaches 19 mph. Time studies show it *averages* 13 mph. This average speed is more than twice as fast as the *top* speed of a crawler-tractor formerly used on this work. Says Superintendent E. A. Heise, "We like this movability! Tournatractor sure gets around fast from one spot to another."

Dozes 180 loads hourly

On the job, this same speed helps Tournatractor equal or better output records of crawlers. Cleaning the edge of the overburden dump, for example, Tournatractor regularly pushes a bladeful of truck-dumped rock and clay over the edge every 20 seconds. Push forward usually takes about 12 seconds . . . change to reverse gear, ½ second . . . return, 8 seconds. Each pass moves up to 2½ bank yards.

Tournatractor also has proved ideal for clean-up around the rock shovel. Rig is maneuverable and fast enough to do the work without interfering with the shovel cycle. On clean-up after shooting, it moves in fast and reduces lost waiting time to minimum.

1/3 the lubricating time

Columbia Quarry also report they save time on maintenance, too. It takes Operator Vern Kremmel just 15 minutes a day to lubricate the Tournatractor, compared to 45 minutes a day to lubricate a crawler-tractor. He says, "Tournatractor is *easy* to oil and grease. You don't have to get down into the mud to do any of the work, so you don't get nearly as dirty."

Why not investigate the high speeds, greater mobility, and lower maintenance Tournatractor can give. Call us to arrange a demonstration. No obligation.

Tournatractor—Trademark Reg. U.S. Pat. Off. T-786-Q-bww

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

IN GRINDING MATERIALS

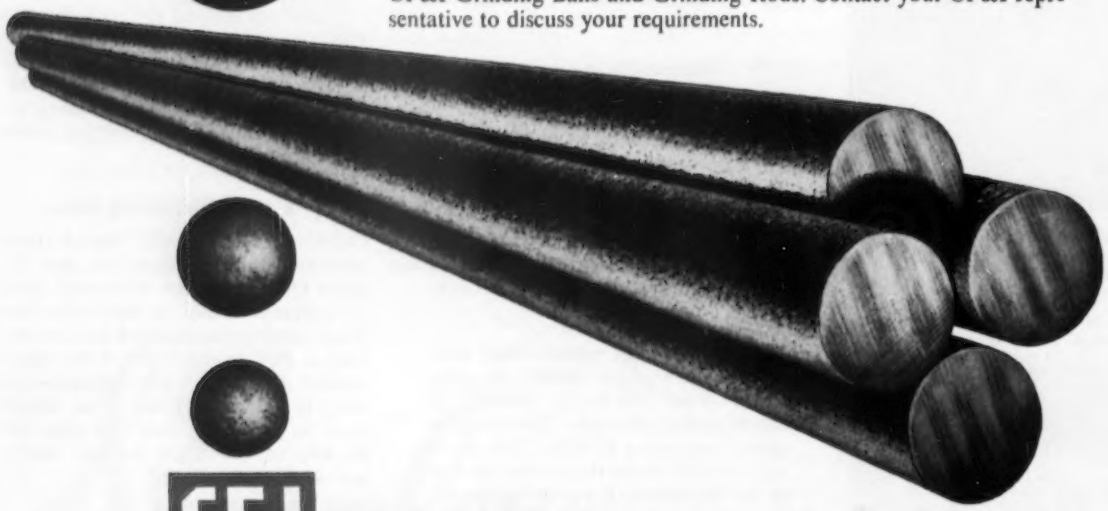
your best buy is CF&I

. . . AND HERE'S WHY: All grinding balls look alike, and cost pretty much the same. This holds true for grinding rods, too. This being the case, the best way to buy is on the reputation of the manufacturer and the performance record of his products.

CF&I, for example, has an established reputation as a leading manufacturer of quality products for use in the mining industry. Having grown up in close geographical proximity to the western mining industry, CF&I has gained unmatched "know-how" in the production of grinding materials. It is this "know-how," applied at every point in the manufacturing process from ore to finished product, that assures you of getting the best when you specify CF&I Grinding Balls or Rods . . . whatever your grinding application.

As for product performance, CF&I Grinding Balls, forged from special analysis steel, have an ideal balance between toughness and hardness . . . are well known for their optimum grinding ability and wearability. And CF&I Grinding Rods, also made from special analysis steel, machine straightened, and with square-cut ends, have an established reputation for efficiency and economy in grinding operations.

Whatever your grinding material needs, it will pay you to consider CF&I Grinding Balls and Grinding Rods. Contact your CF&I representative to discuss your requirements.



CF&I

THE COLORADO FUEL AND IRON CORPORATION

3563

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Casper • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City • San Antonio San Francisco • Seattle • Spokane • Wichita • CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Montreal • Toronto • Vancouver • Winnipeg

MINE USES

for self-powered scrapers

Tournapulls may be self-loaded, push-loaded, or shovel-loaded. The 7½-yard "D" shown here hauls at speeds to 28 mph, unloads in seconds, makes complete turn in 26 feet. Simple electric controls and big 4-wheel air brakes permit rig to work safely at high speeds in tightly restricted quarters.

Read the following list of mine-scraper-applications, developed from an editorial published recently by Mechanization Magazine . . . analyze these scraper economies for your open pits

1 In auxiliary stripping, where overburden is so thick that the wash or earth must be removed to allow boom-type equipment to work within its economical limits.

2 Where spoil room for boom-tool operations is inadequate; where outcrop is bothered by property lines, highways, railroads, pipe lines, power lines and undivertable streams.

Rigs make 180° turns, in less than machine's length, operate in tight quarters as shown above. Tournapulls keep working in tough going when other self-powered scrapers bog down. When one wheel slips, exclusive power-transfer differential automatically transfers power to wheel on firmest footing. Positive geared steer on kingpin pivots prime-mover from side to side, "walking" drive wheels to fresh footing.

3 Widening a bench at the side of the pit to provide greater casting area for shovel or dragline.

4 Stripping wet top-layers of earth, which might slough and cause slides into a shovel cut.

5 Cutting the initial box-cut, depositing the spoil out-of-the-way of later dragline operations.

6 Stripping or mining small or isolated veins that do not warrant the expense of moving large excavating equipment to the site.

7 Stripping hillside and hilltop operations...self-powered scrapers particularly adapted for this type of work.

8 Cutting new beds for temporary or permanent stream diversions; building dams and settling ponds.

9 Building grades for railroads and for truck haul-roads.

10 Construction and maintenance of ditch and drainage systems.

11 Grading around mine buildings and mine location housing.

12 Land-fill disposal of refuse.

13 Stockpiling of coal . . . spreads in even layers, compacts while hauling.

14 Supplementary hauling of ore, coal, or overburden...open-top scraper can be shovel-loaded and used as a truck-type hauler.

15 Mining lean ore, previously abandoned, in widely scattered or isolated areas.

16 Stripping overburden where level piling of spoil is required.

17 Stripping shallow overburden which does not justify expense of installing and operating major excavating equipment.

18 Leveling spoil piles for drainage, reforestation, farming, etc.

19 Removing and replacing top-soil for reclamation purposes.

If you have any of the above dirt-moving problems...write us or check with your nearest LeTourneau-Westinghouse Distributor. We'll be glad to have our experienced field engineers analyze your operation and propose suitable procedure and equipment for most economical handling. Our rubber-tired prime-mover-scraper combinations are available in three sizes: "D" . . . 138 hp . . . 7½ yards heaped capacity; "C" . . . 208 hp . . . 18 yards heaped capacity; BIG "B" . . . 293 hp . . . 25-yards heaped.

Tournapull—Trademark Reg. U.S. Pat. Off. G-1015-M-b

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

how to get the most out of HOLLOW DRILL RODS

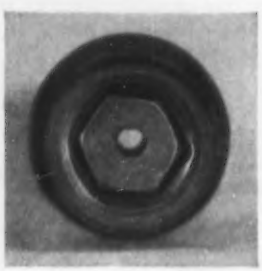
Modern drill rods – especially new *alloy* hollow drill rods like Crucible CA DOUBLE DIAMOND or 4E – give longer drill life than was possible with straight carbon rods. They'll give you lower cost per foot of hole drilled on the job. They will, that is, if you let them. For *abuse* will stop even the best steel from doing its best job. And you pay the price in higher drilling costs.

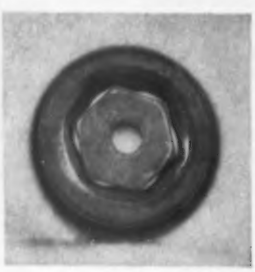
Rods properly racked and stored give better service.

Take, for example, MAINTENANCE:

DRILLS — Pneumatic drills are often so badly in need of repair that good drilling is impossible. Early failure of any rod used in these drills is inevitable. The solution is regular, periodic inspection of all drills and equipment – replacement of worn or damaged parts.

The damaged and worn striking faces of these pistons prevent impact from being transmitted to the rod in a straight line. Rod failure results.





RODS — It's a temptation to store drills by throwing them into one big pile. Resist it. For nicks and surface damage result – drill failures occur at points of damage.

BITS — Keep bits sharp. A dull bit binds in the hole, and drills so slowly that little useful work is performed. But the drill steel must absorb the rugged blows of the hammer.

Proper bit maintenance pays off.

It pays big dividends to make good maintenance a habit. Quality drill steels, like Crucible CA DOUBLE DIAMOND or 4E Alloy Hollow Drill Rods, are made to give long service, lowest cost per foot of hole drilled. They're tough, strong, made to tool steel standards. This *extra* quality assures you of minimum rod breakage, fewer valuable bit losses. But to bring out the best in 'em, you've got to do your part by keeping equipment in shape.

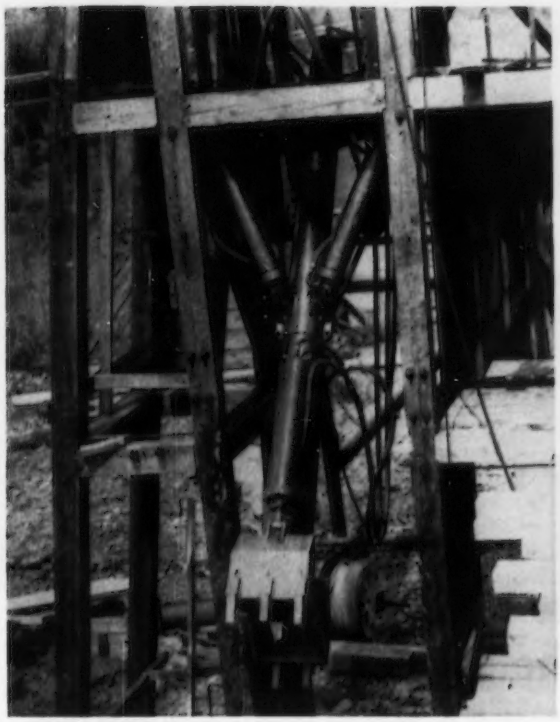
Crucible hollow drill rods are always quickly available in the sizes and types you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

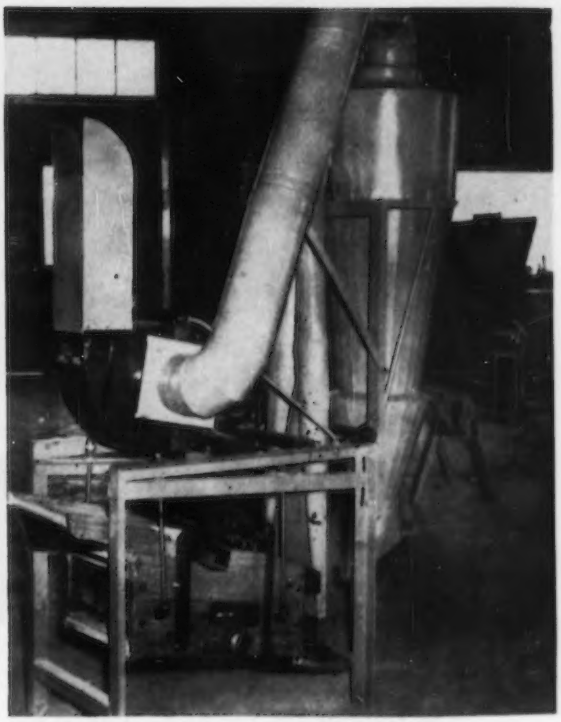
E&MJ NEW PRODUCTS DIGEST

LLOYD E. ANTONIDES, Assistant Editor



Shaft Mucker (1)

"JUST LIKE A MAN'S HAND" is one description for the Cryderman Shaft Mucker now commercially available from Shaft & Development Machines Co., Salt Lake City, Utah. Seven air cylinders actuate the device which works equally well in inclined or vertical shafts. Only two levers control all move. ments. Telescopic boom can reach any place in shaft. Positive controlled crowding action, plus positive loading and positioning of bucket gives any desired digging pressure at all times. Story of development and use was in *E&MJ*, May 1955.

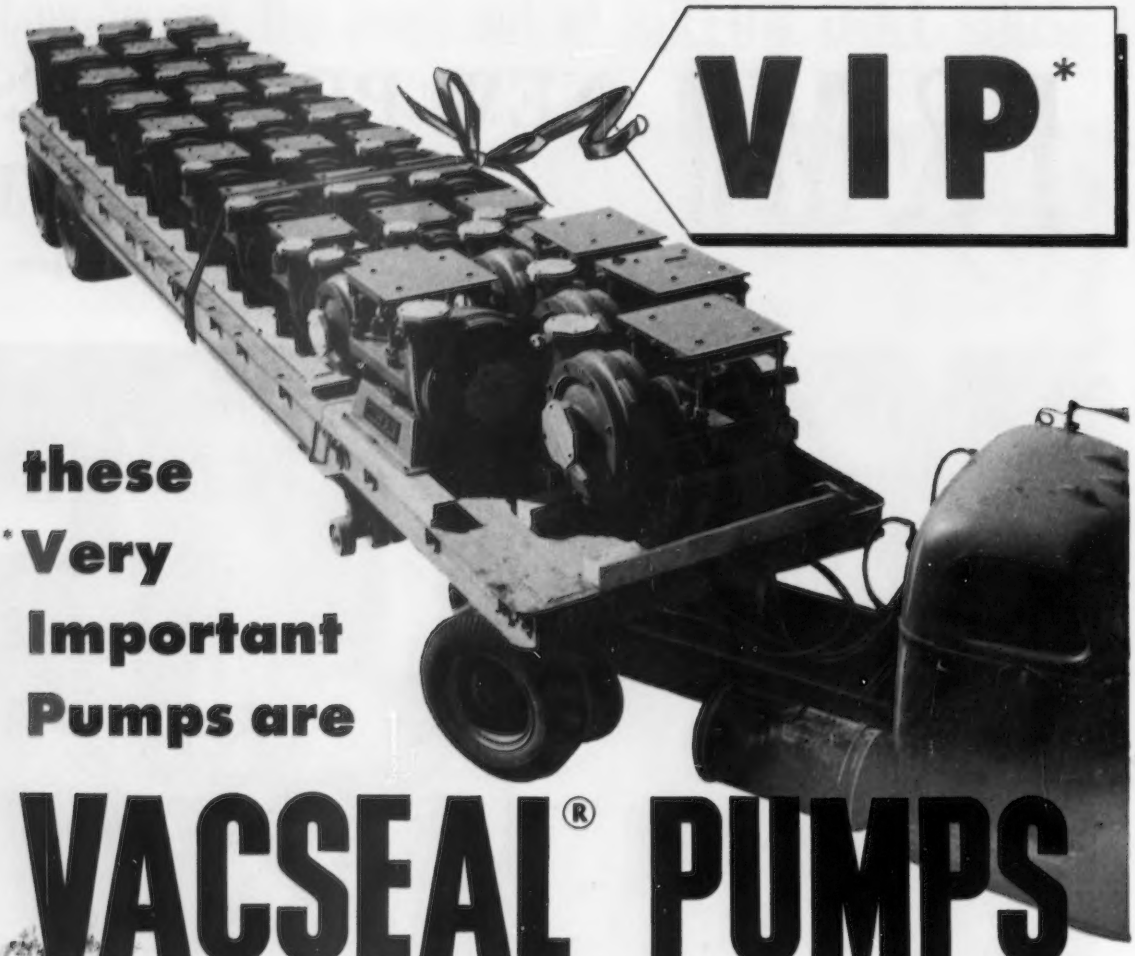


Dry Concentrator (2)

AIR FLOW is successfully used to separate minerals in this dry concentrator, according to Clute Mfg. Co., Rocky Ford, Colo. They claim tests show any mineral can be separated from gangue if difference in specific gravity is 1% or more. They say unit has been especially successful treating mica ore. After crushing to part mineral grains, ore is fed over shaking screens and material is lifted off at several points by air suction. After passing through ducts and cyclones concentrate drops from air stream into bins.

Rock Drill (3)

DEMONSTRATION MODEL rotary drill made by Joy Mfg. Co., Pittsburgh, Pa., for underground mining in medium hard rock is operated by hydraulic motors and cylinders. In this rubber-tired, hydraulically self propelled unit a 26-hp electric motor drives hydraulic pumps. Called HPD-1 High Pressure Drill, it is said to penetrate two to five times as fast as standard percussion types in same ground—drilling 1⅜- to 1⅝-in. holes 9 to 12 ft deep at speeds of 3 to 10 fpm. Stated to be applicable to limestone, marble, copper ore, iron ore, lead and zinc ore, etc., it uses a tungsten carbide tipped, finger or drag rotary-type detachable bit on sectional hollow round (E rod) steel.



VIP*

these
*Very
Important
Pumps are

VACSEAL® PUMPS

Destined for service in the strategic metals field

This truckload of VACSEAL® Pumps will be playing an important role in handling pulps in a strategic mineral plant . . . another assignment for versatile VACSEAL® Pumps in the constantly widening range of industrial applications. To meet the varied requirements of all kinds of pumping jobs, VACSEAL® Pumps can be rubber-lined, hard-iron or special alloy; acid-proof or standard . . . providing a full range for handling abrasive or corrosive pulps . . . and in sizes from 1½" to 8".

VACSEAL's® unique design—*the elimination of gland leakage without use of sealing water* is one of the main reasons for its wide acceptance by industries with pumping operations. Its vast saving incident to wear on shaft and gland counts in a big way in ultimate profits.

Write for the complete VACSEAL® Pump story. No obligation.

GALIGHER PRODUCTS
Commercial and Laboratory AGITAIR®
VACSEAL Pump
Vertical VACSEAL Pump
Acid-Proof Sump Pump
Laboratory Ball Mills
Geary-Jennings Sampler
Geary Reagent Feeder
Laboratory Pressure Filters

Leaders in Experience & Service

THE GALIGHER CO.

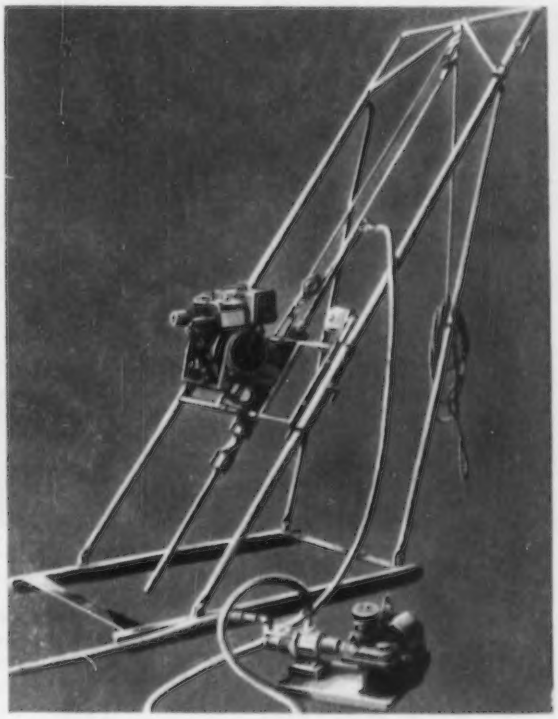
METALLURGICAL DIVISION · ENGINEERING SERVICE

CONSULTATION • ORE TESTING
PLANT DESIGN • GEOLOGIC INVESTIGATION

HOME OFFICE: 545 West 8th South, Salt Lake City, Utah, P. O. Box 209
EASTERN OFFICE: 921 Bergen Avenue, (Room 721) Jersey City, New Jersey
Agents In All Principal Foreign Mining Districts

Rock Auger **(4)**

Primarily designed to drill long blast holes in softer rock, CP-555 Rotauger is offered by Chicago Pneumatic Tool Co., New York, N. Y. In formations such as medium limestones, gypsum, talc and softer iron ore, it is claimed to outperform percussion drills by a wide margin—drilling 2½-in. holes to depths of 100 and more feet at speeds of 2 to 4 fpm. Air operated, it uses sectional auger-type steel with a variety of tungsten carbide tipped bits.



Prospecting Drill **(5)**

Angle holes are no obstacle with this portable, 700 lb complete, rotary rig offered by Hitchcock Mfg. Co., Sun Valley, Calif. Called the Wonder Drill, it is claimed to cut a ⅞-in. core with a 1½-in. diamond bit to 100 or more feet. A 2⅜-in. two-cone rotary bit also can be used. Rods are 1⅛-in. OD. Power unit for drill, 3.35-hp gasoline engine, swivels to remain upright whether drilling vertically or inclined. Pump has separate power unit.

Laboratory Unit **(6)**

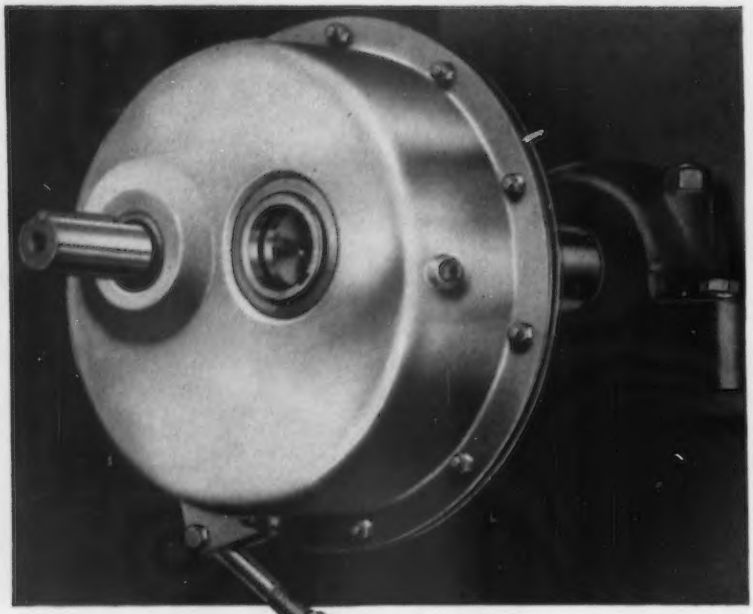
Magni-Whirl utility water bath offered by Blue M Electric Co., Blue Island, Ill., has a quickset mercury thermo regulator. Magnetic pumping action is said to give gentle agitation to all areas of bath, and to be silent and more efficient than propeller agitation without cutting down working volume. Temperature range: room to 100 deg C.

Back-Hoe Digger **(7)**

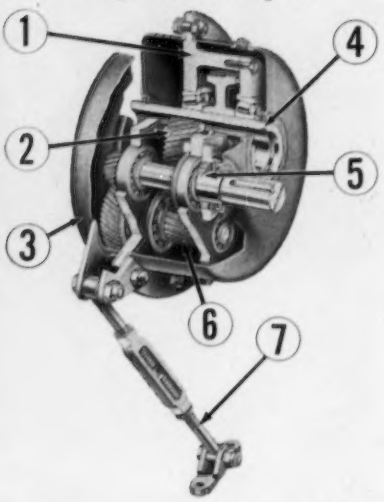
Back-hoe that digs at right angles to either side of tractor as well as to rear is introduced by Mid-Western Industries Inc., Wichita, Kan. Unit can load trucks or dump well clear of trench. Seat revolves with boom so operator always faces bucket. Unit can be readily attached to or detached from Davis front end loader and uses same hydraulic system.

Arc Welding Machine **(8)**

Lincwelder 100 is described as so foolproof that anyone can use it without experience. It is simple, compact and lightweight. It is offered as a "build-it-yourself" unit for miscellaneous odd jobs by the Lincoln Electric Co., Cleveland, Ohio. Conventional welding electrodes are used and it can be used to cut as well. Optional torch is for soldering.



These famous FALK "In-built" factors *mean long life and dependability...*



SIX SIZES

- 1/2 to 30 hp
- Single or double reduction
- Wide output speed range—420 to 10 rpm

FALK

ALL-STEEL

Shaft Mounted Drives—

simple-compact-rugged-efficient

Created specifically for the vast number of applications demanding a sturdy and compact speed-reducing unit for direct mounting on the driven shaft, the new Falk all-steel Shaft Mounted Drive is built to give long service life at substantial savings of space, time, power and maintenance costs!

This efficient helical-gear drive, latest in the unmatched list of Falk precision-gearing achievements is an ingenious modification of the time-tested Falk Motoreducer design which has held, for more than 20 years, recognized leadership in this branch of highest-quality power transmission . . . It complements and completes the world-famous Falk line of reduction units covering the entire range of industrial applications.

Investigate the Falk all-steel Shaft Mounted Drive. Write to Department 247 for engineering bulletin, including selection and dimension details.

1 **All-steel Frame,** with more than double the rigidity of iron, supports all rotating elements.

2 **Precision Helical Gears,** designed and machined by Falk, rated to AGMA standards.

3 **Pressed Steel Housings,** whose sole function is to keep oil in, dirt out; easily removed for gear inspection without dismounting unit.

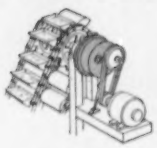
4 **Through Hollow Shaft** with counter bore provides for easiest installation or removal from driven machine shaft extensions.

5 **Backstop** can be furnished with the unit or added later for positive prevention of reverse rotation.

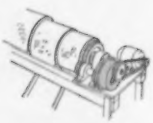
6 **Positive Lubrication,** continuous direct dip of revolving elements at all speeds.

7 **Tie Rod** and turnbuckle serve as anchor and facilitate V-belt or chain adjustment.

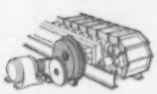
A FEW TYPICAL APPLICATIONS



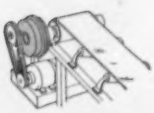
BUCKET ELEVATOR



SAND CLASSIFIER



APRON FEEDER



BELT CONVEYOR

THE FALK CORPORATION, Milwaukee 8, Wisconsin

MANUFACTURERS OF

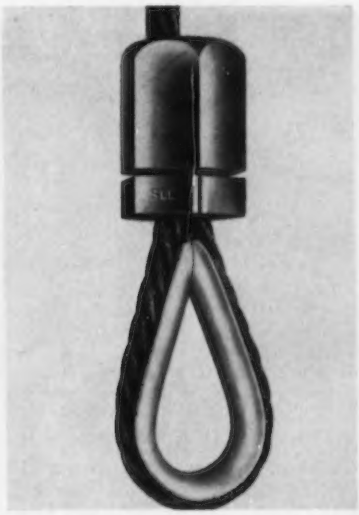
- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

FALK

. . . a good name in industry

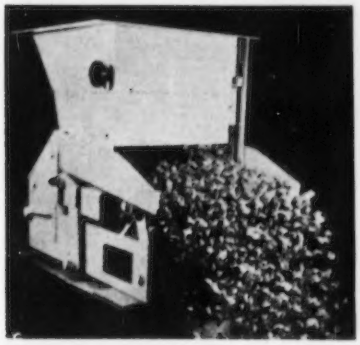
Audible Signal (9)

Guard Horn produced by Falcon Alarm Co. Inc., Summit, N. J., sounds shrill 110-decibel signals that carry up to a mile. It is powered by Freon, has belt clip, and we ghs under 1½ lb.



Wire Rope Clamp (10)

Claimed as a stronger, quicker-to-use and lower-cost reuseable wire rope clamp, Safe-Line by Lamson & Sessions Co., Cleveland, Ohio, grips tight when grooved halves are screwed together.



Vibrating Feeder (11)

Compact Velofeeder uses vibration to give an adjustable uniform feed with low power and maintenance, says Richardson Scale Co., Clifton, N. J. Capacity is given as up to 25 tph.

Exhaust Spark Arrestor (12)

Attached to end of exhaust pipe of internal combustion engines, Gill Spark Arrestor safely traps incandescent sparks by centrifugal force says Erickson Products Co., San Francisco, Calif.

Ore Analyzer (13)

For determining amount of uranium and thorium in ores, Tracerlab Inc., Boston, Mass., is now manufacturing an analyzing unit. Scintillation detector and geiger tube are mounted on sample well. One reads Beta count; other, gamma.

Flame-Resistant Screen (14)

Designed to provide protection from intense heat, arc flash, molten splash, flying chips and scale, etc., flame-resistant curtains and blankets are offered by Eastern Equipment Co. Inc., Willow Grove, Pa. They are custom made.

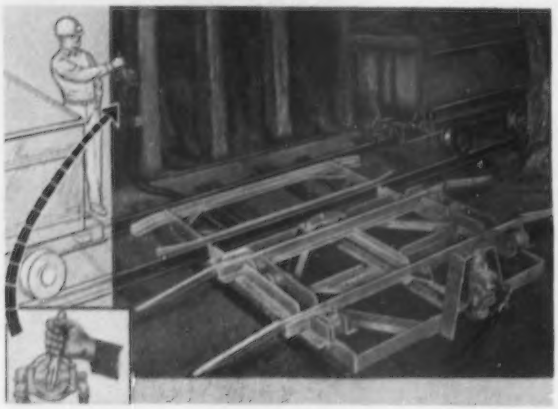
Patching Concrete (15)

Cracks and holes are repaired with little delay to traffic by use of Stonset compound, according to Stonhard Co., Philadelphia, Pa. Ready to use, it sets in 40 minutes and can be used to anchor machines and bolts to concrete bases.

Spectrograph (16)

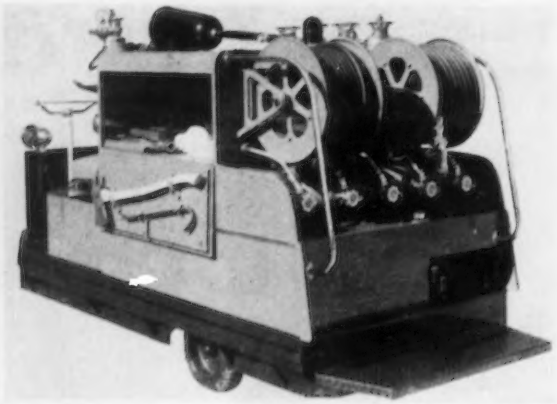
Autrometer, multi-element indexing X-ray spectrograph from North American Phillips Co. Inc., Mt. Vernon, N. Y., analyzes as many as 24 elements in a specimen. Console desk-type unit has several automatic features.

SIZE
SEPARATE
DELIQUEFY
BEE-ZEE SCREENS
Tri-Rod, for knife-like separation
Round Rod, for long-lived accuracy
Grizzly Rod, for best features of round and tri-rod
Grizzly Rod with skid rod, for abrasion protection
Bee-Zee Screens are "sure-shaped"—their electronically precision welded rods have the **exact** cross-sectional shape your screening operation requires. That shape **makes you money!** For drier "deliquefying"...for greater accuracy and long life ...let Bee-Zee make screens tailored to your specifications. Bee-Zee Screens are 100% stainless steel ...can't rust, can't corrode. For complete facts, write or wire—or call us collect at Galesburg, Ill., 4397
BIXBY-ZIMMER Engineering Co.
516 Abingdon Street • Galesburg, Illinois



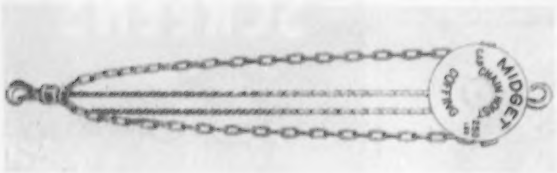
Car Transfer (17)

One man can now transfer mine cars with this air powered unit. Made by American Mine Door Co., Canton, Ohio, it is similar to their hand operated "Canton" car transfer. According to release, unit is easily moved and set up without altering track in any way. Reversible air motor drives chain attached to truck section. Control valve can be fastened in any convenient location. Hand model can be converted easily, it is said.



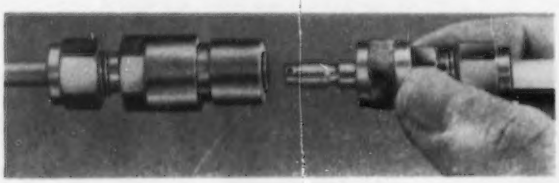
Fire Truck (18)

This compact "in-plant" fire truck carries carbon dioxide, dry chemical, water and foam equipment. It is designated as Model S-556 by Seco Engrg. & Mfg. Div., Seco Safety Products Co., Detroit, Mich. Three wheeled, gasoline engine powered truck has speed of 15 mph, turning radius of 96 in. and is 50 in. wide by 68 in. high. It has ladder cabinet for extension ladder, accessory cabinet and 100-ft hoses for water fog and CO_2.



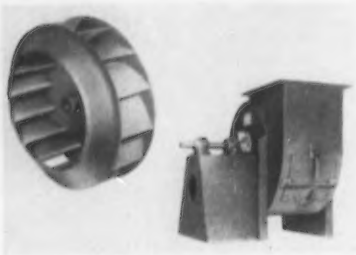
Chain Hoist (19)

An 11-lb Midget chain hoist, capable of lifting 250 lb, has been developed by Coffing Hoist Div., Duff-Norton Co., Danville, Ill., to "fill a long-felt need for a small, fast and safe hoist." Minimum distance between hooks is 9 in. and standard lift is 7 ft but extra chain can be added.



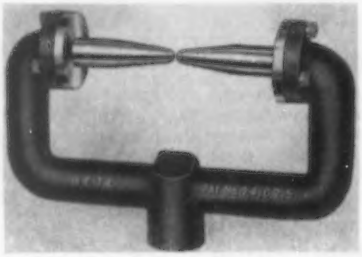
Tubing Connection (20)

Swagelok Quick Connect fitting, made by Crawford Fitting Co., Cleveland, Ohio, is easily connected and disconnected by hand. Shutoff valve incorporated in it prevents leakage while making or breaking connection. Internal design is said to allow freer flow than with other similar types.



Centrifugal Fan (21)

Hollow airplane wing-like blades of Airfoil centrifugal fans are claimed chiefly responsible for: efficiencies above 92%, 35% less hp and 65% less noise than conventional fans—says Chicago Blower Corp., Franklin Park, Ill.



Fog Nozzles (22)

O. J. series are opposed jet impingement-type nozzles announced by Bete Fog Nozzle Inc., Greenfield, Mass. For flows of 3 to 30 gpm, tips are said to be designed to give best possible atomization efficiency and uniform drop size.

Mobile Shovel-Crane (23)

Four new machines and five new carriers are announced by Quick-Way Truck Shovel Co., Denver, Colo. Versatile attachments can be used on all models. Units include 5-ton, ½ yd; 8-ton, ⅜ yd; 10-ton, ½ yd; and 12½-ton, ½ yd.

Solid Rubber Tires (24)

Industrial truck equipment users are offered a line of solid pressed-on solid rubber tires by U. S. Rubber Co., New York, N. Y. Outer surface is made of compound especially good for chip resistance and long wear. Base is resilient.

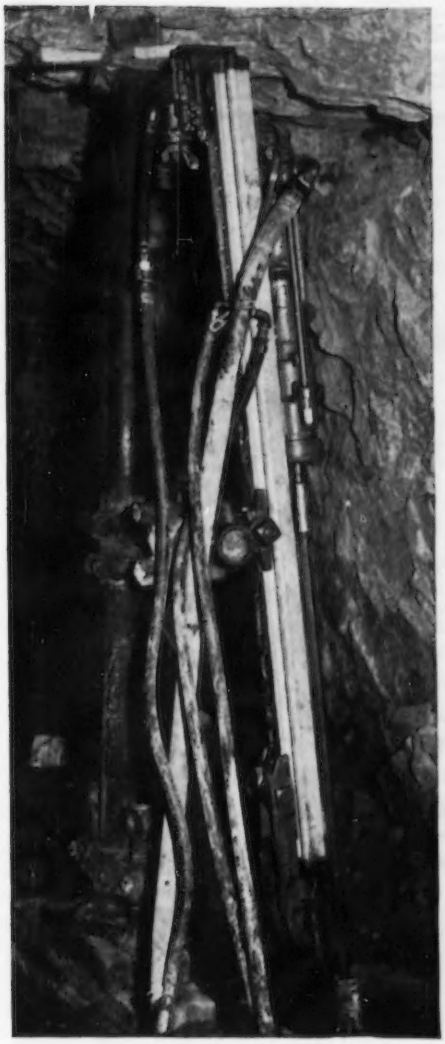
Battery-Water Unit (25)

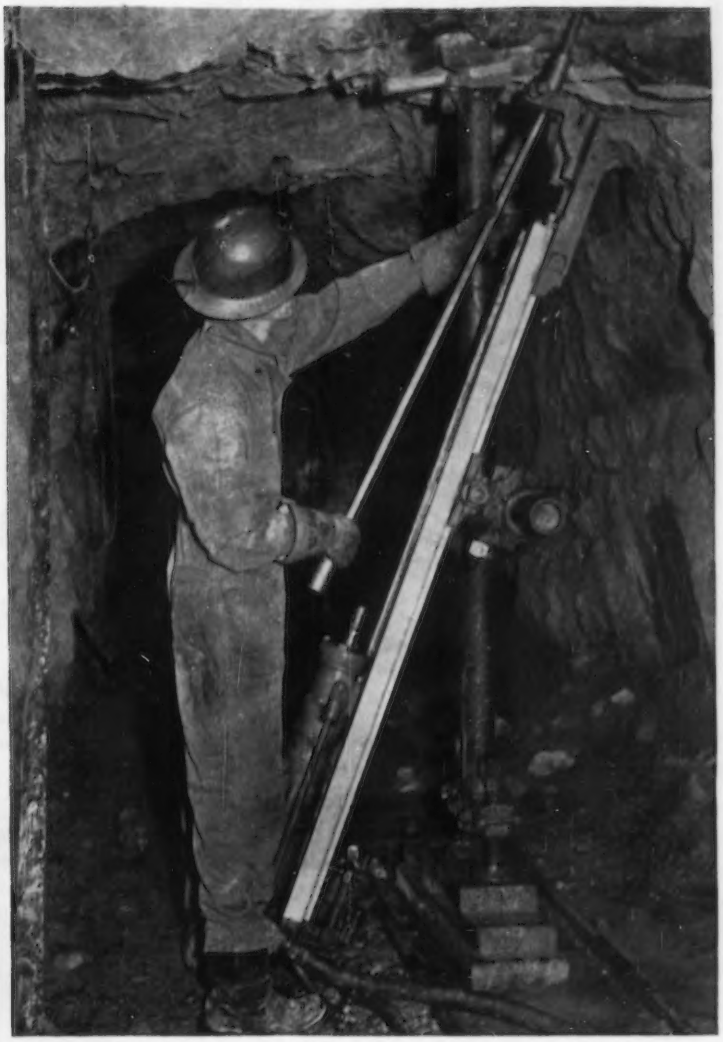
Ion-exchange is used in Hydrion unit to give mineral free battery-water from ordinary faucet without heat or power. Throw away canister refills are used. Simple-to-use device is made by A. E. Tomkin & Co., Washington, D. C.

Ultra-Violet Lamp (26)

NH Mineralight lamp from Ultra-Violet Products Inc., San Gabriel, Calif., is very inexpensive. It operates on 110 v ac. Not designed as a professional model it may still be useful in identifying most fluorescent minerals.

Gardner-Denver... Serving the World's Basic Industries





Reduce ore breakage costs by 50% to 75% with Gardner-Denver Deep Hole Drills

Permit ring drilling to 100 feet or more from a 7-foot development drift. Also for bench holes, stoping, slashing, pillar recovery.

Engineered deep hole equipment includes 4″ or 4½″ drills, long feed aluminum guideshells, Ring Seal Shank, sectional rods and couplings, bit adapter for carbide bits.

Send for illustrated bulletin on deep hole drilling . . . it's packed with application reports and equipment specifications.

GARDNER - DENVER

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Best place to head for is your Caterpillar Dealer.

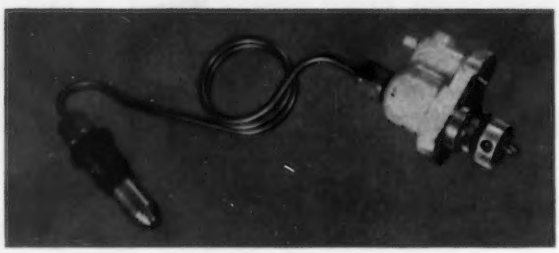
If the trouble's with substitute fuel injection parts, you should know this:

Original Caterpillar fuel pumps and injection valves are made from very special steel — the finest chromium alloy ball-bearing type. They're made with special tools in a special factory—only one of its kind in the world. Each pump is pre-set and given a 6-hour run-in. Single orifice design of valve cuts down possibility of fouling. In short, with Caterpillar parts you're sure of better performance, less down time.

With substitute parts, can you be sure of anything?

Better get Caterpillar original parts every time.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.



With clean fuel, CAT* fuel injection valves and pumps can last 20,000 hours and more. They are 100% interchangeable among cylinders of same engine or like models.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

NEW PRODUCTS DIGEST *(Continued)*

Seismograph (27)

Seismograph system 7000B is called an all purpose unit by Houston Technical Laboratories, Houston, Tex. It is designed for all types of seismic recording—high to low frequency, reflection or refraction. It is said to offer linear recording over wide frequency range, to function with magnetic recording and yet weighs no more than standard system.

Roof Coating (29)

Liquid neoprene coating, Gaco Roof, can weatherproof any kind of roof says Gates Engineering Co., Wilmington, Del. No preparation other than sweeping roof and driving exposed nailheads below surface is needed, they say. It is reported to be applied easily with roofer's brush and to air-cure in one hour. Elastic film is claimed fire-resistant.

Portable Acid Pump (28)

For transferring acids from open vessels as well as standard carboys and drums, Centri-F pump is offered as a convenient safe unit by General Scientific Equipment Co., Philadelphia, Pa. Lightweight for portability, it is completely self-draining. Specially designed enclosed electric motor drives self-priming pump to give spurt-free flow of 6 gpm.

Burn Ointment (30)

F.O.B. is supplied in an aerosol spray can. Non-toxic, non-irritating and containing no harmful drugs, it can be used on any part of body as a complete treatment for burns, according to E. D. Bullard Co., San Francisco, Calif. Application is painless and sanitary, and relief from pain is rapid it is said. Several sizes are available.

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

PRESSURE LEAF FILTERS booklet offered by Hercules Filter Corp., Hawthorne, N. J., is packed with information on their use. Principles of liquid filtration as well as selection criteria are only two of the many topics. **(31)**

REFRACTORIES, castable and plastic, are described in 16-page publication from Ramtite Co. Div., S. Obermayer Co., Chicago, Ill. Typical applications and suggestions on how to use the material in various furnaces are included. **(32)**

ELECTRICAL CABLE & WIRE available from Okonite Co., Passaic, N. J., are cataloged in bulletin just released. They say their two selection charts—one by application, one by cable type—are highly practical. **(33)**

FLEXIBLE HOSE & DUCTS are covered rather thoroughly in concise folder put out by Flexhaust Co., New York, N. Y. Flexhaust is hose; Portovent is duct. Prices, constructions and accessories are given. **(34)**

PORTABLE & SEMI-PORTABLE MILLS are shown and described in bulletin published by Denver Equipment Co., Denver, Colo. Units shown are playing an important part in exploiting small orebodies and as pilot plants for large. **(35)**

ANTI-CORROSION COATINGS made by Amercoat Corp., South Gate, Calif., are concisely presented in brochure. Description of recommended applications and procedure for applying various systems is done well. Reasons why are given too. **(36)**

METAL GRATING report from Klemp Metal Grating Corp., Chicago, Ill., discusses the wide field of usage. Engineering specifications are detailed, including safe load table, standard sizes and construction. **(37)**

INDUSTRIAL TRUCK COSTS is subject of 4-page folder available from Elwell-Parker Electric Co., Cleveland, Ohio. It tells how to figure them and then how to lower them. Checklist is given for evaluation of factors. **(38)**

LOW TEMPERATURE BRAZING applications are shown in periodical from Handy & Harmon, New York, N. Y. Use of Sil-Fos brand silver brazing alloy in plumbing work on new buildings is subject of latest folder. **(39)**

LABORATORY APPARATUS is subject of publication called Announcer. New equipment and supplies are described and priced, and a section is devoted to general topics of interest to lab people. It is from E. Machlett & Son, N. Y., N. Y. **(40)**

AEC RESEARCH REPORTS are indexed in a monthly publication recently started by Office of Technical Services, U. S. Department of Commerce. Reports of industrial significance are to be made public as promptly as possible. **(41)**

FEB. 1956

NOT GOOD AFTER APRIL 1, 1956
if mailed in U. S. or Canada

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	15	29	43	57	71	85
2	16	30	44	58	72	86
3	17	31	45	59	73	87
4	18	32	46	60	74	88
5	19	33	47	61	75	89
6	20	34	48	62	76	90
7	21	35	49	63	77	91
8	22	36	50	64	78	92
9	23	37	51	65	79	93
10	24	38	52	66	80	94
11	25	39	53	67	81	95
12	26	40	54	68	82	96
13	27	41	55	69	83	97
14	28	42	56	70	84	98

Name .....

Title .....

Company .....

Address .....

For More Details—Circle Numbers Enter Name & Address, Mail

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9, P.L.&R.)
NEW YORK, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed In The United States

Postage Will be Paid By—

McGRAW-HILL PUBLISHING CO., INC.

ENGINEERING & MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 36, N. Y.

BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in The United States

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9, P.L.&R.)
NEW YORK, N. Y.

Postage Will Be Paid By—

McGRAW-HILL PUBLISHING CO., INC.

ENGINEERING & MINING JOURNAL
330 WEST 42nd STREET
NEW YORK 36, N. Y.

For More Details—Circle Numbers Enter Name & Address, Mail

FEB. 1956

NOT GOOD AFTER APRIL 1, 1956
if mailed in U. S. or Canada

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	15	29	43	57	71	85
2	16	30	44	58	72	86
3	17	31	45	59	73	87
4	18	32	46	60	74	88
5	19	33	47	61	75	89
6	20	34	48	62	76	90
7	21	35	49	63	77	91
8	22	36	50	64	78	92
9	23	37	51	65	79	93
10	24	38	52	66	80	94
11	25	39	53	67	81	95
12	26	40	54	68	82	96
13	27	41	55	69	83	97
14	28	42	56	70	84	98

Name .....

Title .....

Company .....

Address .....

NEW PRODUCTS DIGEST *(Continued)*

HARDNESS DATA on celluloid pocket card from International Nickel Co. Inc., N. Y., N. Y., gives relationship between Brinell, DPH (Vickers), Rockwell and Shore Scleroscope hardness values, and corresponding tensile strength of steels. **(42)**

VACUUM VALVES, bellows type, by Kinney Mfg. Div., New York Air Brake Co., Boston, Mass., are described in catalog bulletin just issued. Metal bellows seals valve stem and is said to prevent leakage under high vacuum. **(43)**

INDUSTRIAL EQUIPMENT of a wide variety are featured in a general catalog of Precision Equipment Co., Chicago, Ill. Shelving, lockers, storage units of all kinds and miscellaneous equipment difficult to find elsewhere are shown. **(44)**

TACHOMETERS, stationary type, are subject of catalog folder from Metron Instrument Co., Denver, Colo. Several take-off heads are available for fitting most situations. Indicators and controllers can be remotely located. **(45)**

OPTICAL AIDS available from Edmund Scientific Corp., Barrington, N. J., are listed in new catalog. Prices are given as well as descriptions and illustrations of a large number of optical instruments and components. **(46)**

INSTRUMENTS to measure temperature, air velocity and dew point are cataloged in bulletin from Illinois Testing Laboratories Inc., Chicago, Ill. Brief descriptions give outstanding features of each. Some controls are shown. **(47)**

NICKEL PLATING process called Sulfamate Nickel Plating is explained in technical bulletin offered by Hanson-VanWinkle-Manning Co., Matawan, N. J. Complete technical instructions including list of equipment needed are given. **(48)**

MAGNETOSTRICTION TRANSDUCERS are covered in a booklet from International Nickel Co. Inc., New York, N. Y. While mostly concerned with design of those made of nickel, it gives some fundamentals of device used in sonic and ultrasonic fields. Though not mentioned, it is used in experimental rock drill. **(49)**

WORM GEARS, double-enveloping type, are covered in bulletin available from Cone-Drive Gears Div., Michigan Tool Co., Detroit, Mich. It primarily gives details on assembly procedure. **(50)**

GAS MASK vision data to help buyers compare leading makes on that basis, is contained in special test bulletin by Acme Protection Equipment Co., South Haven, Mich. **(51)**

LITHIUM CARBONATE uses are described in an informational bulletin issued by American Potash & Chemical Corp., Los Angeles, Calif. Pamphlet gives some background on chemical and physical characteristics and suggested uses. **(52)**

ALUMINUM mill products are presented in a brochure prepared by Harvey Aluminum, Torrance, Calif. Illustrations and text describe complete range of wrought aluminum structurals, tube, extrusions and forgings. **(53)**

TACHOMETERS made by Herman H. Sticht Co. Inc., New York, N. Y., are described in condensed form in bulletin released. Some portable and some stationary types are shown, including several new instruments. **(54)**

ELECTRICAL CONDUIT that is flexible, liquid-tight and corrosion-resistant is described in brief bulletin from American Brass Co., American Metal Hose Div., Waterbury, Conn. Called Sealtite, it consists of flexible galvanized steel core with PVC outer cover. **(57)**

STEAM CLEANERS made by Malsbary Mfg. Co., Oakland, Calif. are illustrated and described in brochure. Chart gives comparative performance data of various models. **(58)**

FLUID DRIVE called Gyrol designed for diesel engine application is discussed in bulletin from American Blower Corp., Detroit, Mich. Type VS Class 2F is an adjustable speed drive suitable for drill rigs. **(59)**

PULVERIZER offered by Pulva Corp., Perth Amboy, N. J., and described in condensed bulletin, is an impact-type unit called the Pulva-Sizer. Five sizes from ¾ to 75 hp are available. It is said to give close size control. **(60)**

MOTOR-GENERATOR SETS from 200 to 7,000 kw are covered in bulletin from Allis-Chalmers Mfg. Co., Milwaukee, Wis. They are designed to convert ac to dc for mine hoist, rolling mill and similar use. **(61)**

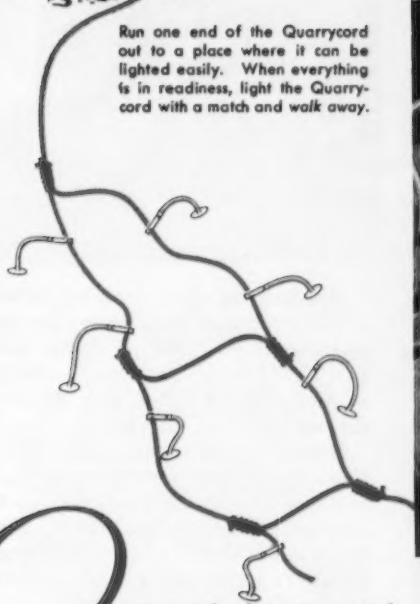
MULTI-V BELTS made by B. F. Goodrich, Akron, Ohio, are specified in a data sheet. Features of patented grommet construction are explained. Chart of sizes and other data as well as interchange list of other brands is given. **(62)**

IDLERS for belt conveyors offered by Barber-Greene Co., Aurora, Ill., are shown in folder. Twelve styles "for every requirement" are pictured. **(63)**

WELDING MACHINE rebuilding service is offered by Lincoln Electric Co., Cleveland, Ohio. Linconditioning Div. has expanded and gives standard new machine guarantee on its work. Company claims another full service life at half cost. **(64)**

HEAVY MEDIA separation testing in recently developed unit (*E&MJ* NPD Dec. 54) is offered by Ore & Chemical Corp., New York, N. Y., at pilot plant in White Haven, Pa. Carload samples are required. **(65)**

Run one end of the Quarrycord out to a place where it can be lighted easily. When everything is in readiness, light the Quarrycord with a match and walk away.



Quarrycord

(PLEASE GIVE THIS ADVERTISEMENT TO YOUR BLASTING FOREMAN)

for one-shot lighting of safety fuse in secondary blasting

Now you can ignite each and every safety fuse from *one point*, and eliminate the hazard of men climbing over the rock pile, lighting each fuse individually.

Now you can have the advantage of fuse blasting, so that the holes go "pop-pop-pop" rather than "BOOM" — to reduce the noise of a single blast.

Now you can fire when convenient, without fear of stray electrical currents causing premature blasts.

Quarrycord is a flexible, water-resistant cord which burns with an external flame at the rate of about one foot per second.

It is very easy to use: (1) Prepare each primer cartridge in the usual way with safety fuse and detonating cap. (2) On the end of the fuse opposite the cap place a Quarrycord Connector. (3) Load and tamp the holes. (4) When ready to blast, run a line of Quarrycord so as to connect with each hole (5) At each fuse, pass the Quarrycord into the slot in the end of the connector and press the "lid" down *tight* over it to make positive contact. (6) If your hook-up has parallel lines of Quarrycord, make frequent cross connections as shown.

Quarrycord is packed on spools in 500 foot lengths, two spools to a box. Connectors are supplied in cardboard boxes containing 100 each.

For more information see your Explosives Supplier, or write to

THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut

Manufacturers of Primacord® Detonating Fuse, Safety Fuse, Ignitacord®, Blasting Accessories.

Established 1836

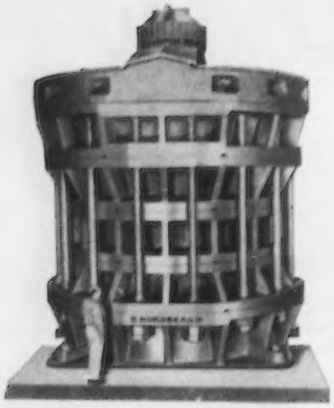
Free Folder **tells the whole story: what it does, and how to use it. Every Blaster should have a copy — send for it today.**

ENSIGN-BICKFORD

Quarrycord

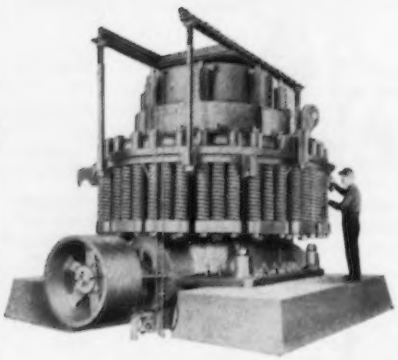
for lighting Safety Fuse in Secondary Blasting

Q-4



SYMONS® PRIMARY GYRATORY CRUSHERS... Built in sizes from 30" to 72" feed openings to meet any desired production operation.

SYMONS CONE CRUSHERS... The machines that revolutionized crushing practice. Built in sizes from 22" to 7' diameter heads with a wide range of capacity.



NORDBERG MACHINERY for the MINING INDUSTRY

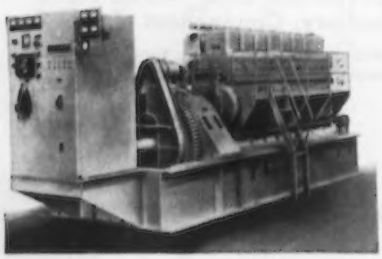
For base metals...precious metals ...the rarer elements...non-metallics and minerals . . . NORDBERG MACHINERY is the outstanding choice of producers in the mining industry the world over.

More than half a century of progressive engineering achievement, combined with quality production, in unexcelled manufacturing plants, have firmly established Nordberg's leading position in the field of heavy machinery design and construction.

Nordberg Machinery assures maximum and continuous production at low operating and maintenance cost. For full details, write for literature on the machinery you need.

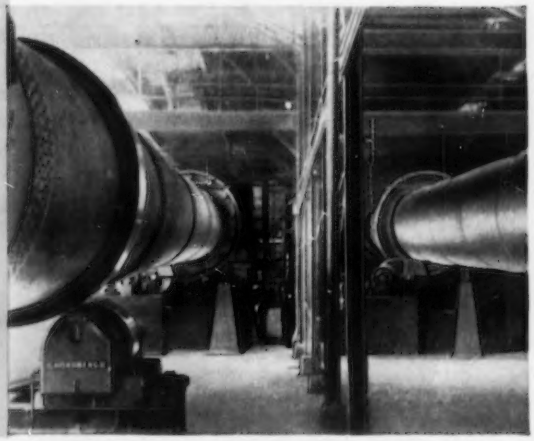
NORDBERG MFG. CO.
Milwaukee, Wisconsin

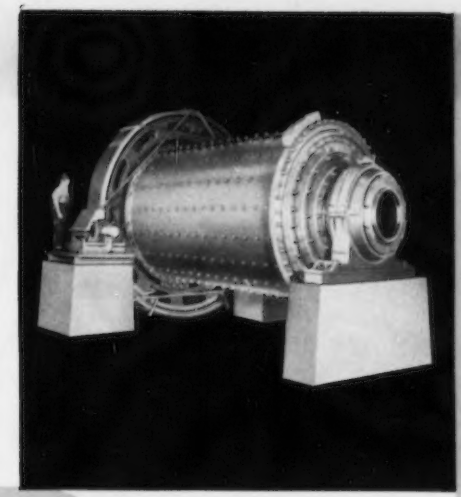
NORDBERG MINE HOISTS... As the source of the most progressive hoist engineering advances in the mining industry, Nordberg has held worldwide leadership in the hoist field since 1895.



NORDBERG ENGINES . . . For oil, gas or Duafuel® operation. Built in sizes from 10 to over 10,000 horsepower to meet practically all power requirements.

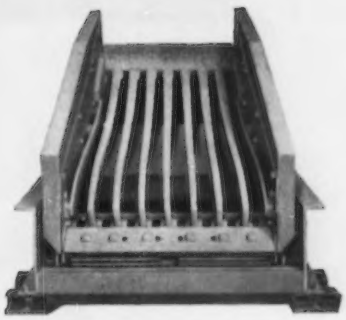
NORDBERG KILNS — DRYERS and COOLERS... To meet a wide range of requirements, including pyro processing operations, drying, calcining burning and cooling.

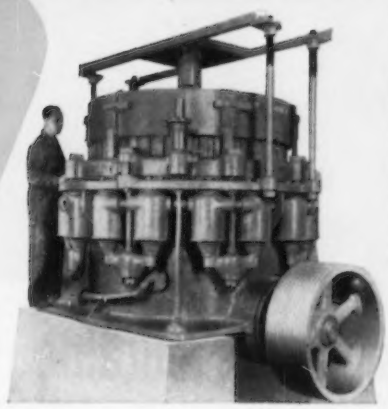




NORDBERG GRINDING MILLS . . . Ball, tube, rod and compartment types for wet or dry, open or closed circuit operation.

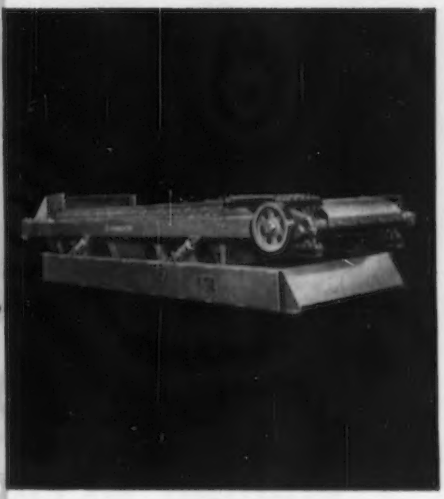
SYMONS VIBRATING GRIZZLIES . . . Built in bar and rod types for effective heavy duty scalping service handling feed sizes up to 30" and larger.

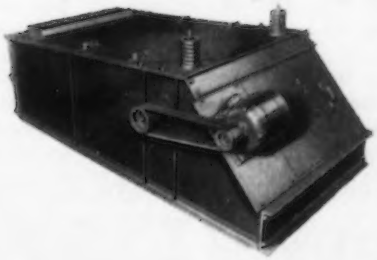




NORDBERG GYRADISC CRUSHER . . . A revolutionary machine for the production of large tonnages of extremely fine product.

SYMONS HORIZONTAL VIBRATING SCREENS . . . Level position assures extreme accuracy in sizing, requires less headroom, permits easy installation.





SYMONS ROD DECK SCREENS . . . Highly efficient screening surface of spring steel rods—easily replaced. Especially suited for wet, sticky materials.

SYMONS "V" SCREENS . . . For extremely fine, single cut wet or dry separations. Employs controlled diffused feed and vertical flow of material.

© 1955, Nordberg Mfg. Co.

M 155-R

NORDBERG MACHINERY

NORDBERG

CRUSHERS SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

SYMONS . . .

A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

620 lbs. lighter, more portable, and more durable . . .

Welded Assembly of USS "T-1" Steel Cuts Grapples Weight 47%

It isn't the logs that wear out log grapples like these. But dropping the grapples 10, 25, or 30 feet, twice a minute, hour after hour, day after day, does wear them out. They literally destroy themselves. That's why light weight is important. And toughness. And strength.

Mack Welding Company, Duluth, Minnesota, has cut weight of grapples 620 lbs. and simultaneously *increased* durability, just by switching from mild steel to rugged USS "T-1" Steel. Here is what they say about "T-1":

"We thought we had reached the lowest possible weight when we manufactured a previous model weighing 1300 pounds. But these new grapples made from your 'T-1' Steel weigh only 680 pounds—just a little over half as much. That's an important advantage for loggers who have relatively small-capacity truck-mounted cranes. No other rolled steel plate would give us such light weight in grapples capable of handling up to 3 ton loads."

"T-1" WELDS BEAUTIFULLY!

"As far as fabrication is concerned, we find that 'T-1' Steel welds beautifully and can be flame cut in exactly the same way as mild steel, without distortion or any other difficulty. We're very pleased with it."

"T-1" Steel is unique. For it gives you a combination of high tensile and yield strength (105,000 psi and 90,000 psi), good high temperature strength, extreme toughness at sub-zero temperatures, good resistance to abrasion, impact, and abuse. You get all of these properties in one steel that is easy to weld.

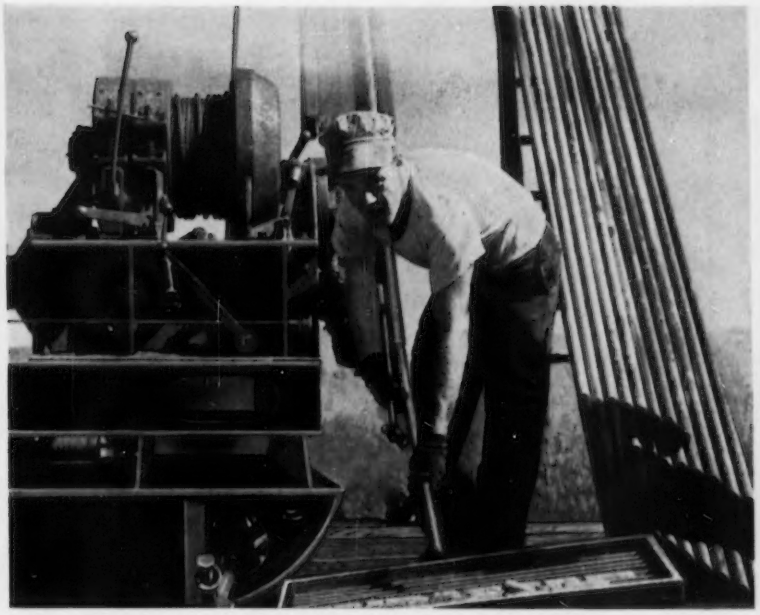
You can use "T-1" to reduce weight . . . to lengthen service life . . . to reduce costs. Look around you. You'll find a job for it—a job that no other steel can do so well. United States Steel, Room 5135, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

USS

UNITED STATES STEEL



CONTRACT DRILLERS

SINCE 1883

Founded more than seventy years ago, in the heart of the then rapidly-expanding anthracite industry, Sprague & Henwood, Inc. pioneered many important developments in Diamond Core Drilling that have stood the test of time.

During this long period of successful operation our crews have completed thousands of drilling contracts, in all parts of the United States and in many other countries. Satisfactory results were secured in some cases where other drillers failed, through the use of special equipment designed by our experienced excutives and built in our own extensive shops.

Today, we have a large force of expert operators and an ample supply of modern equipment, so that we can undertake practically any job, anywhere, on short notice. Inquiries for all types of contract drilling work are solicited — estimates submitted promptly without charge or obligation.

SPRAGUE & HENWOOD INC., Scranton 2, Pa.

NEW YORK • PHILADELPHIA • PITTSBURGH • GRAND JUNCTION, COL. • BUCHANS, NFLD.
EXPORT REPRESENTATIVE, PHILIPS EXPORT CO., 100 EAST 42nd STREET, NEW YORK, N.Y.

NEW LIGHT-WEIGHT HIGH-SPEED CORE DRILLING MACHINES

Model 30 and Model L-2

Supplementing our well-known line of heavy-duty machines for large-diameter and deep-hole drilling we now offer two light-weight high-speed core drilling machines suitable for either Skid, Trailer or Truck mounting. Both models can be powered by either gasoline or diesel engines and air or electric motors. Easily moved from one location to another, they can also be relied upon to produce good smooth cores rapidly at minimum expense.

Standard single-pole derrick permits pulling rods or casing up to 10-ft. lengths

Modern simplified design includes convenient controls, machine-cut alloy-steel gears, anti-friction bearings and other improved features to assure low-cost trouble-free operation. Write for illustrated leaflets containing complete descriptions and working data.

Model 30, Truck Mounted

Complete drilling rigs, mounted on 4-wheel-drive trucks with capacity for carrying accessory equipment and supplies.

MODEL 30 TRAILER MOUNTED

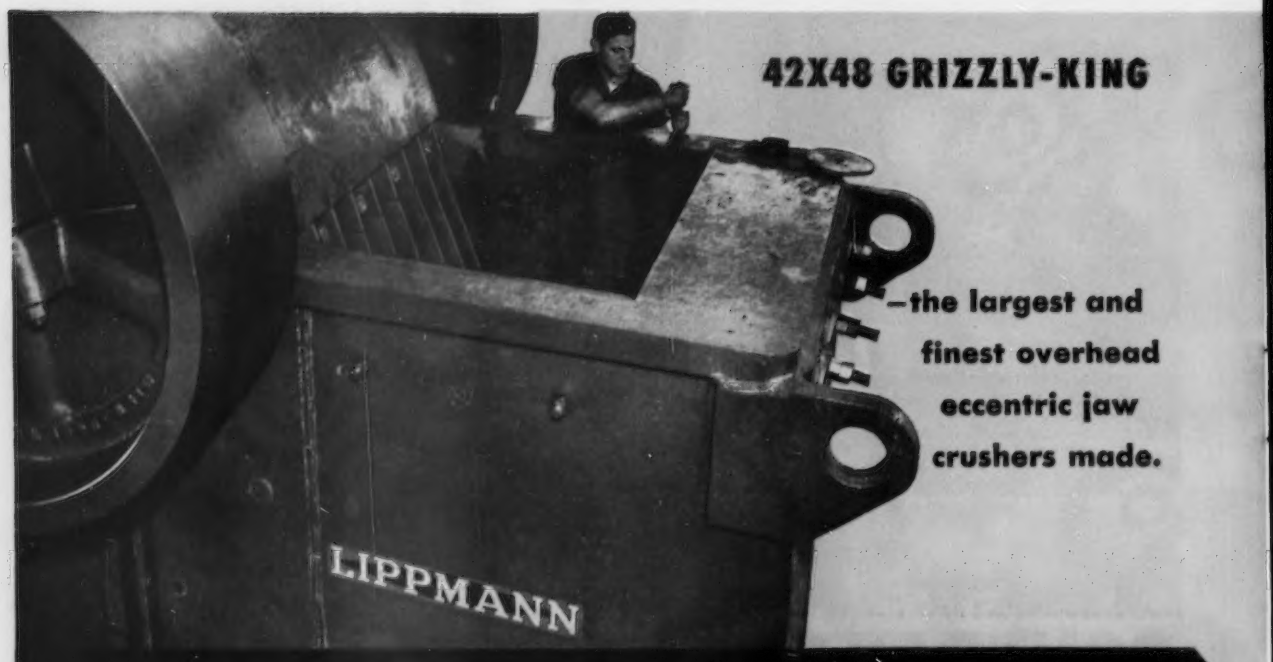
for easy portability without tying up a truck.

MODEL 30 SKID MOUNTED

for jobs not easily accessible by truck or trailer. Wide structural-steel base and low center of gravity provide ample stability.

Leading Manufacturers of High-Speed Diamond Core Drilling Machines, "Oriented" Diamond Bits and a complete line of Improved Accessory Equipment for Core Drilling and Soil Sampling. Write for illustrated catalogues containing complete specifications and all necessary working data on:

Auger Bits, all types	Corebarrels, all types	Drive Pipe Couplings	Hoisting Rings	Pressure Testers	Sawtooth Bits
Bails, lifting	Corebarrel Taps	Drive Shoes	Hose, Waterswivel	Protectors, Casing	Sheave Wheels
Ball-Bearing Waterswivels	Core Lifters	Extensions, Core Barrel	Hose, Suction	Reamer Shells	Soil Samplers
Bits, Diamond	Couplings, Rod	Fishing Tools	Jar Lengths	Reducers, Rod	Subs
Bits, Blank	Derrick Sheaves	Fishtail Bits	Jaws, Safety Clamp	Rods, Drill	Taps, Fishing
Bits, Chopping	Drill Rods	Flush Coupled Casing	Lifters, Rod	Rod Couplings	Testers, Sample
Bushings, Rod & Casing	Drilling Machines	Foot Safety Clamps	Mud Bits	Rod Taps	Testers, Pressure
Casing, Flush Coupled	Drive Hammers	Hoisting Hooks	Pilot Reamers	Rose Bits	Wash Plugs
Casing Tape	Drive Heads	Hoisting Plugs	Plugs, Hoisting	Safety Clamps	Water Swivels
Clinometers	Drive Pipe	Hoisting Plug Reducers			



GRIZZLY-KING superiority

You just can't appreciate the superiority of a Grizzly-King overhead eccentric jaw crusher until you've seen one in action and talked to those who have them.

Owners will tell you about tremendous production capacity, continuous service records, low jaw-die replacement costs, freedom from servicing and adjustment, low power costs.

No wonder Lippmann Grizzly-Kings continue to dominate the giant size (30x42 to 42x48) as well as regular size (12x36 to 24x36) overhead eccentric jaw crusher fields. A Grizzly-King was the world's largest 8 years ago and a Grizzly-King is still the world's largest today — in size (dimension and weight), in output (up to 1200 tons per hour) and in maintenance savings (only lubrication in most instances).

That is why the country's largest producers of crushed stone set production and service records with these Lippmann giants . . . and why others are installing them *now*.

You can get Grizzly-King benefits only by using "Grizzly-Kings." And remember this . . . not one of these big Lippmann crushers — whether 42x48 or smaller — has ever failed or failed to satisfy. Learn about Grizzly-King's advantages by contacting your local Lippmann dealer or the factory direct, today. Lippmann Engineering Works, 4623 W. Mitchell St., Milwaukee 14, Wisconsin.

1100-56-1

Typical comments from Grizzly-King owners everywhere: —

"Wouldn't have any other crusher but a Lippmann"

"Crushed 1,200,000 tons without turning jaw dies . . . and they're still going strong"

"During the 5 months it has been in service, it has required no adjusting or servicing except for lubrication"

"Maintenance? Haven't even replaced a die-bolt"

"Haven't turned my Grizzly-King dies even after 2½ million tons"

These 42x48 GRIZZLY-KING crushers, the biggest overhead eccentric jaw crushers ever built, are already established as performance kings in output and low-cost operation.

Davidson, N. C.

Sandusky, Ohio

Chattanooga, Tenn.

Elizabethtown, Ky.

South Zanesville, Ohio

breaking rocks and records ...all over the world

These older installations of GRIZZLY-KING giants have been establishing themselves right along as production leaders in some of the biggest quarries.

Winston-Salem, N. C.

Byington, Ohio

Mitchell, Ohio

New Castle, Pa.

Bloomington, Ind.

LEW LIPPMANN

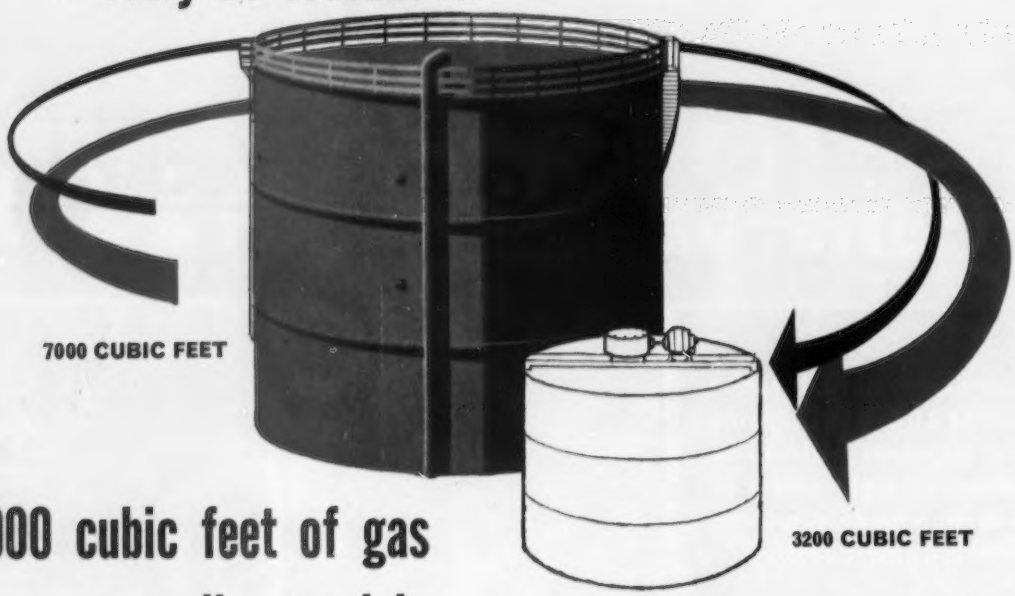
CRUSHERS FEEDERS SCREENS CONVEYORS CRUSHING & WASHING PLANTS

Turbo-Topics

TURBO-MIXER GENERAL AMERICAN TRADE MARK

TURBO-MIXER, a division of
GENERAL AMERICAN TRANSPORTATION CORPORATION

every 60 seconds...



7000 cubic feet of gas dispersed in 3200 cubic feet of liquid —with TURBO on the job

If absorption of gas into liquid is your problem, put Turbo to work. Turbo Gas Absorbers handle up to 7000 cfm with proved operation. They are available in sizes up to 84"—the largest mechanical gas absorbers in operation. What's more, only Turbos can be designed to self-induce gas into the liquid.

Turbos can solve your agitation problems, whether your business is petroleum processing, chemicals, pharmaceuticals or minerals beneficiation. Turbo's built-in ruggedness that provides continuous 24-hour heavy-duty service assures you of "headache-free" production and lower costs in the long run.

SALES OFFICE: 380 MADISON AVENUE, NEW YORK 17, NEW YORK
General Offices: 135 S. La Salle St., Chicago 90, Illinois • Offices in all principal cities
OTHER GENERAL AMERICAN EQUIPMENT:—DRYERS • DEWATERERS TOWERS • TANKS • PRESSURE VESSELS

This plant is safer since they put these Crane valves on hazardous fluids

THE CASE HISTORY—How safely you handle hard-to-hold combustible fluids can depend on the valves you use. Read how a large Midwestern printing and binding plant, by changing to the right valves, encouraged employee care and safety while stopping hazardous leakage and waste.

The plant's supplies of kerosene, naphtha, benzol and similar fluids were stored in a fireproof room. But the danger was in the constant dripping and leakage at the tanks.

The original pump apparatus on the drums was discarded and ordinary valves were installed for drawing supplies. Still the hard-to-hold fluids dripped and leaked—through the valve packing and stuffing box, and at the seats. Fluids were lost . . . the high maintenance costs continued . . . and the unsafe conditions remained.

Changing to Crane No. 130 brass valves on the drum outlets stopped all previous trouble.

To-date they've given more than a year of leak-free, maintenance-free service. These valves have special features for handling light oils, gases and volatile fluids.

Underwriters' Laboratories approved for LP-gases, Crane No. 130 valves have a composition disc soft enough for tight seating, yet stiff and resilient to take hard wear. The disc, cemented in its holder, prevents around-the-disc leakage. The stuffing box with molded asbestos packing is extra deep for durable stem sealing.

No. 130 valves are typical of Crane quality and value, and the complete selection you have in the Crane line in valves and fittings for every flow control need.

You'll find that specifying and ordering Crane materials will lead to lower ultimate costs for your piping equipment.

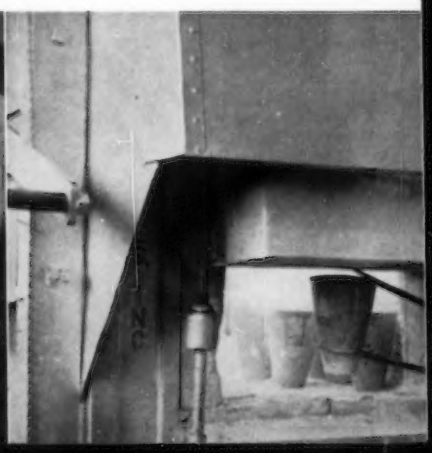
CRANE VALVES & FITTINGS

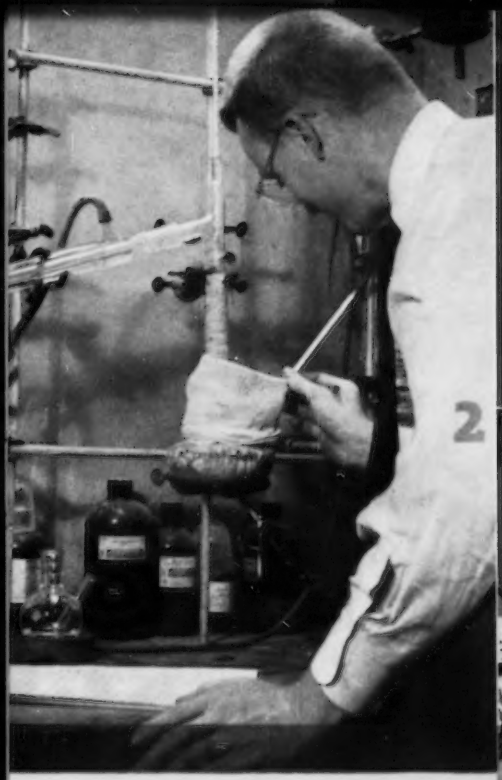
PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

New Tools for the Metallurgist from Cyanamid Research

Research to develop new reagents and improved application methods goes forward unceasingly at Cyanamid's Stamford Research Laboratories. Today, emphasis is upon more efficient treatment techniques for tomorrow's lower grade ores. With a 40-year background in mining chemicals and first-hand knowledge of mill problems derived from its highly-trained field engineers, Cyanamid is particularly well equipped to undertake this important research. From such research come new, more efficient Cyanamid products and processes for treating the leaner, more refractory ores in the competitive days ahead.





1. Valuable reference for reagent researchers is a Molecular Formula Index of over 32,000 compounds that have been synthesized or tested by Cyanamid. This vast compilation of basic data gives our reagent researchers access to the findings of all Cyanamid research in every chemical field.

2. New chemical compounds are synthesized for testing in minerals beneficiation by the Mineral Dressing Laboratory.

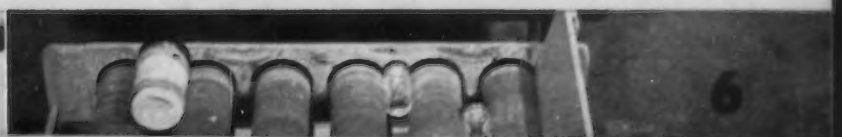
3. & 4. New flotation reagents are given a thorough evaluation by Cyanamid flotation engineers.

5. Highly-trained microscopists are available for examination of minerals and test products.

6. New cyanidation techniques are investigated with testing carried out in bottles on rotating rolls to simulate the agitation of pulp in a cyanide plant.

7. Facilities are available for gold and silver determinations by fire assaying, together with the most modern methods and equipment for conducting chemical analyses.

8. Settling tests with improved AEROFLOC® Reagents are carried out with stirring mechanism to simulate action of thickener rakes.



AMERICAN CYANAMID COMPANY

MINERAL DRESSING DEPARTMENT 30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.

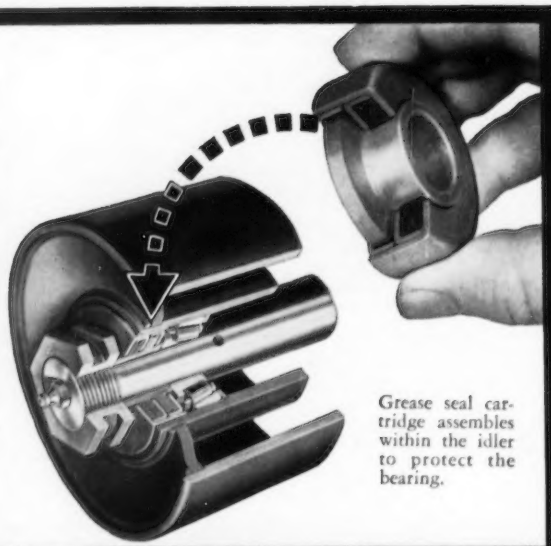
CYANAMID

Today's simplest IDLER GREASE SEAL is also the best-performing

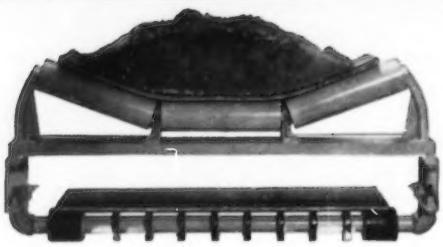
THE cartridge grease seal used on Link-Belt belt conveyor idlers provides the effectiveness of multiple sealing with the convenience of a single unit. A contact seal of laminated felt and neoprene combined with a labyrinth keeps dirt out, grease in. And the grease itself within the labyrinth further prevents entrance of dirt or other matter. What's more, no springs or loose washers are involved . . . there's no chance for metal-on-metal friction. The entire assembly comprises a rugged, compact "cartridge."

Simplicity is only one of the big advantages you get with Link-Belt idlers. Check the others below. For complete facts ask your nearby Link-Belt office or authorized stock-carrying distributor for a copy of Book 2416. It lists over 500 sizes in 34 types, including troughing, variable troughing, flat belt, belt training and rubber cushion idlers.

Sturdy, rigid frames support rolls in perfect alignment. Rolls are securely held in place but easily removed for inspection and service.



Grease seal cartridge assembles within the idler to protect the bearing.



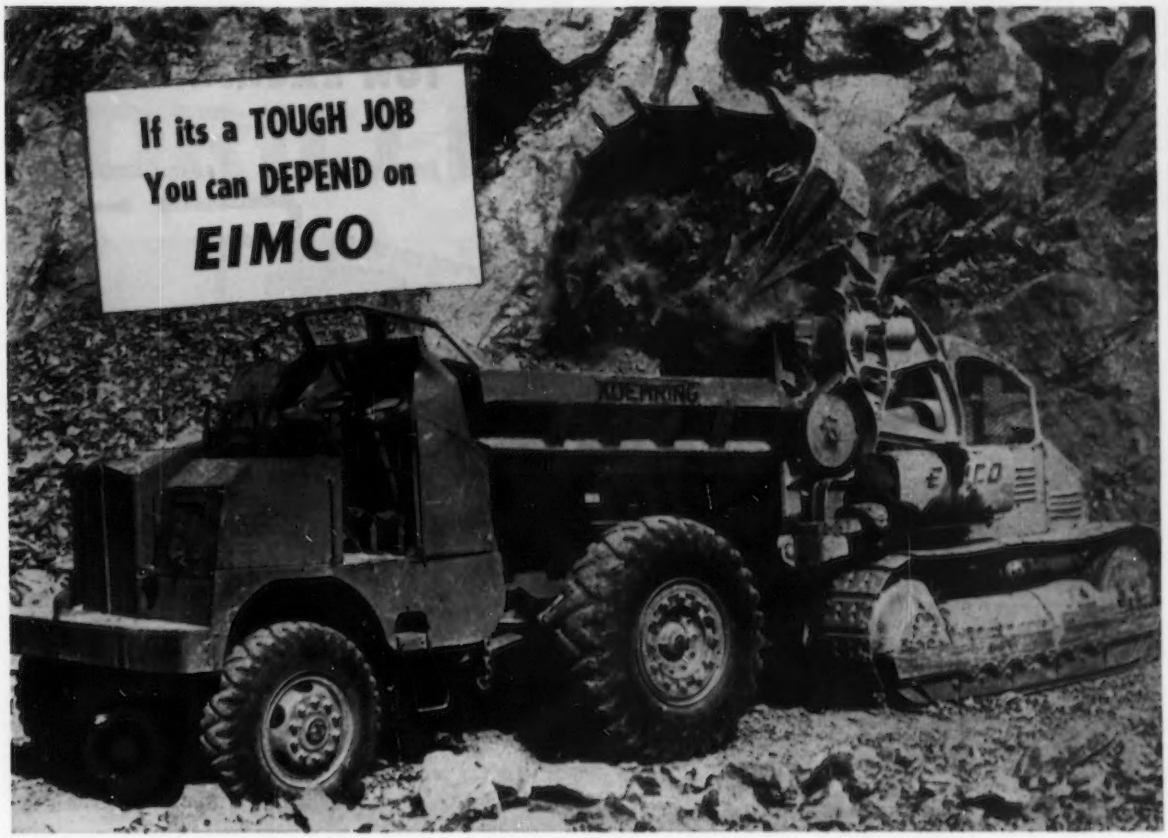
You'll find these 6 features throughout industry's most comprehensive idler line

1. **HUSKY, HIGHEST QUALITY BEARINGS,** free and easy turning, assure maximum life, minimum belt-wear, low power consumption. Concentricity is secured by unit mounting of bearings in a heavy-wall center tube.
2. **SAFE, CONVENIENT GREASE FITTINGS** protected by flange ribs of support brackets provide ease of lubrication—lubrication for longer life.
3. **CONCENTRIC ROLLS** have smooth surfaces and rounded edges. Machine-made, continuous welds prevent entrance of dirt and moisture.
4. **HOP-FREE ROTATION** is assured by close tolerances, press fits and precision assembly from shaft to shell.
5. **STRONG, RIGID FRAMES** support rolls in perfect alignment. Rolls are securely held in place but can be easily removed for inspection and service.
6. **GROOVED HEX NUTS** lock into malleable brackets, creating bridge truss effect—prevent shaft rotation and bracket spreading under load.

LINK-BELT

BELT CONVEYOR IDLERS

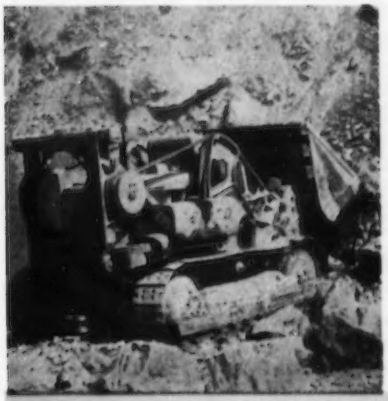
LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13.805



Hard, Rough, Tough Jobs Need Eimco Dependability

This case study concerns one Eimco 105 loader on which an open pit mine depends for its entire production.

Location — in an isolated and remote area of Southwest Africa.



Conditions — dusty, dry and hot. Pit floor uneven-solid rock.
Mining — selective
Operators — native
Maintenance — Nil

Report — The Eimco 105 Tractor Excavator has operated some 3200 hours on consecutive two shift basis under the most difficult conditions. Native operators are unnecessarily abusive of the equipment. The ore is exceptionally abrasive and heavy. No other loading equipment is available so the Eimco must stay on the job. One operator ran the 105 a complete shift without fan belts, both of them run the machine to the solid rock wall and spin the tracks when cleaning out an ore pocket.

Eimco does not recommend abuse on their tractor-excavators or any other equipment but Eimco produces a machine that can stay on the job day in and day out—month in and month out—when you are depending on it and when plant capacity depends on a single production loading unit.

There are many reasons for Eimco superiority on the tough jobs. The design of an Eimco is simple-strong. The material of construction is all alloy steel. The operating features make it the easiest tractor to operate and the most maneuverable. When you need guts in a tractor, compare an Eimco with anything you are using or have used previously.

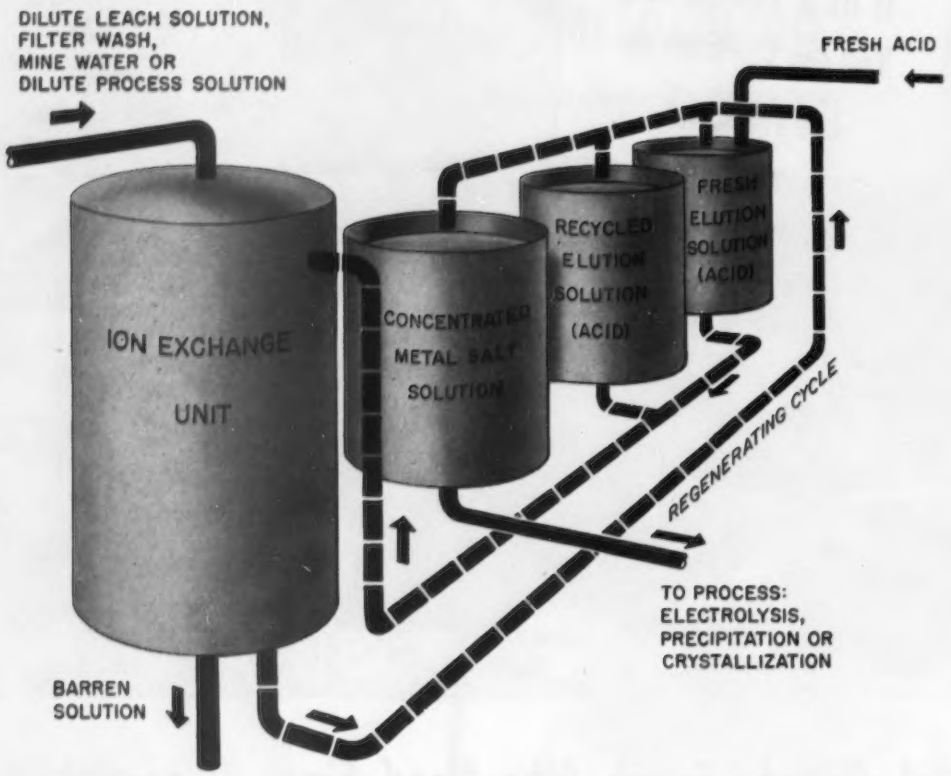
THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-173

METAL CONCENTRATION BY ION EXCHANGE



© The Permutit Company

Ion Exchange gives Better Yields

• Ion exchange increases yields, simplifies flow sheets and cuts labor, supervision and chemical costs when used with other hydrometallurgical processes such as Leaching, Clarification, Filtration, Purification, Precipitation and Electrolysis.

The simplified flow diagram shown above illustrates the main principles of ion exchange in concentrating metals from leach liquors, filter washes, other dilute process solutions or mine waters:

As the feed solution or mine water passes through the ion exchange unit, the metal values are concentrated on the ion exchange resin, generally in preference to other ions present, leaving the solution or mine water metal-free. When the metal-attracting property of the resin is exhausted, an appropriate elution solution, for example an acid, is passed through the resin to pick up the metal. In most cases, the elution solution also acts as regenerant to restore the metal-attracting capacity of the resin . . . as shown on the diagram. Recycling the elution solution provides high concentrations . . . often several thousand times as concentrated as the original feed solution.

Ion Exchange methods apply to these metals:

Base Metals	Minor Metals	Precious Metals
Copper	Cobalt	Gold
Zinc	Tungsten	Silver
Lead	Molybdenum	Platinum
Tin	Vanadium	**Rare Earths**
Aluminum	**Decorative Metals**	Lanthanide Group
	Nickel	Actinide Group
	Chromium	Uranium

The Permutit Company not only designs and builds complete ion exchange systems, but also manufactures ion exchange resins and zeolites for all industrial applications. For information, write: The Permutit Company, Dept. EMJ-2, 330 West 42nd St., New York 36, N. Y.

PERMUTIT
Rhymes with "Compute it"

LESS WASTED DRILLING TIME !

TIMKEN® interchangeable rock bits let you switch bit types without switching drill steels

Dozens of different TIMKEN® multi-use and carbide insert bits fit the same steel

YOUR drillers can change Timken® interchangeable rock bits quickly, easily, right on the job. They won't waste valuable drilling time going after a different set of drill steels every time a different bit type is needed. They'll simply unscrew one type of Timken bit and screw another right on the same steel. And they can make this change in one minute flat!

You get extra drilling economy because your drillers can always switch to the most economical bit as the ground changes—right on the job. And because dozens of different Timken multi-use and carbide insert bits fit the same steel, you don't have to carry an expensive inventory of drill steels.

Both Timken carbide insert and multi-use bits are made from electric furnace Timken fine alloy steel. Both have special shoulder unions that keep drilling impact from damaging threads.

Our rock bit engineers are experts at cutting drilling costs. Maybe they can save you some money? Drop them a line. There's no obligation. Write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

WHERE YOU CUT COSTS WITH TIMKEN MULTI-USE BITS

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

Give highest speed through hard, abrasive ground. Also most economical for constant-gage holes, small diameter holes, very deep holes.

... your best bet for the best bit... for every job

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

F-100 8-ft. Pickup—GVW 5,000 lbs.

T-800—GVW 42,000 lbs.; GCW 65,000 lbs.

FORD BIG JOBS can mean

FORD EXPERIENCE IN HEAVY DUTY ENGINES PAYS OFF . . .

- **Much longer peak engine performance!**
- **Much less DOWN TIME on the job!**

Ford Trucks for '56 save you money right from the start. And, they keep on saving with their extra-sturdy, long-life engine design.

For instance . . . Ford Engineers have now introduced into all heavy-duty engines the greatest valve advancements ever. As an example, see the exhaust valve in diagram on right page. The valve stem is hollow and partially filled with powdered sodium. When the sodium gets hot, it *turns into a liquid.* As it moves up and down, it carries heat away from valve head—*allows it to operate up to 225° cooler!* Result: a cleaner-running, more burn-free, longer-lived valve face.

Ford's long-lasting engine design pays off for you in every way. You save money on parts replacements such as piston rings and bearings. You save on shop labor—extend time between preventive maintenance jobs like valve adjustments, valve grindings, compression tests, ring jobs and the like.

And you can save on driver costs if you can keep trucks out of the shop and on the road. Yes, you save in every way when you get more work done per truck!

There's a Ford Truck for every trucking job. Before you buy your next truck, Test Drive a Ford Economy Truck.

FORD TRUCKS LAST LONGER

Certified by independent insurance actuaries for the ninth consecutive year! Studies of over 10,068,600 current license registrations show that Ford Trucks last up to 9.9% longer than any of the other 4 leading truck makes!

F-900—GVW 29,000 lbs.; GCW 60,000 lbs.

BIG SAVINGS in your business

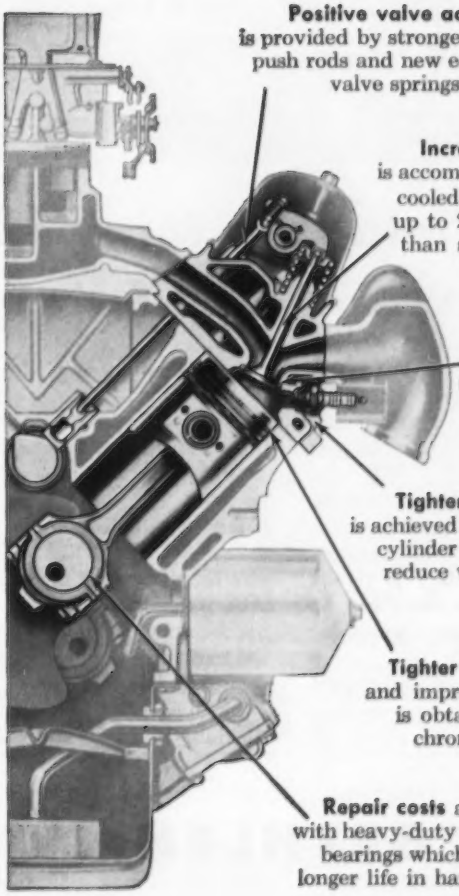
Hauls up to 3000 lbs. more than other 6-wheelers—New Ford T-800

● New power and hauling capacity of the Ford Tandem BIG JOB cuts hauling time on every run—makes giant cargos seem lightweight. You have a choice of two gas-saving Short Stroke engines. Either the 190-h.p. *Torque King* Y-8 or, the 200-h.p. *Torque King* Special Y-8.

You have new engine advancements for longer life (some explained and illustrated at the right).

New high-capacity tubeless tires, heavy-duty 5-speed transmission and Power Steering are standard equipment, at no extra cost. Two 3-speed auxiliary transmissions and full-air brakes are available at low extra cost.

New *Driverized* Cabs for driving comfort and convenience have *Lifeguard* Design safety features found in no other truck. Lifeguard steering wheel helps protect driver from steering column; Lifeguard door latches help keep doors from jarring open in case of accident.



Positive valve action is provided by stronger, tubular push rods and new equal-coil valve springs.

Increased valve life is accomplished with sodium-cooled exhaust valves—up to 225° cooler-running than solid-stem valves.

Longer valve and seat life are the result of solid tungsten-cobalt alloy facings and exhaust valve seat inserts.

Tighter valve closing is achieved with stress-relieved cylinder heads that help reduce valve distortion.

Tighter compression seal and improved ring durability is obtained with thicker chrome-plated rings.

Repair costs are lower with heavy-duty copper-lead bearings which provide longer life in hard service.

Yieldable Mine Roof Support Means Greater Safety and Less Cost

We're in a slusher drift at an Eastern ore mine. The workmen have completed the erection of those steel arches and are now installing lagging to finish off the job.

The arches have probably caught your eye, and well they might for they represent one of the greatest advances in mine safety in recent years. From now on, you will be hearing a lot about the Bethlehem Yieldable Mine Arch!

Each arch consists of rolled-steel segments, nested into one another and bolted together at points of overlap. Joints are made with U-bolt clamps drawn tight enough to hold fast under normal loads. But when unusually heavy pressures begin to bear down, the joints permit the nested segments to slide or yield before deformation of the steel can take place. The load is thus relieved and the structural integrity of the arch is maintained. The safety of underground personnel is secure, and the roof structure itself continues in service undamaged.

The impressive appearance of the Yieldable Arch may suggest a luxury item, but exactly the reverse is true. The fact is, you can safely figure on regaining the reasonable first cost of the Yieldable Arch in its first year of service. These steel arches will far outlive heavy timber supports, and have the very important advantage of recoverability. One of our engineers will be glad to describe this safety development in full detail at your convenience.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Cut down man hours! Speed up hole drilling!

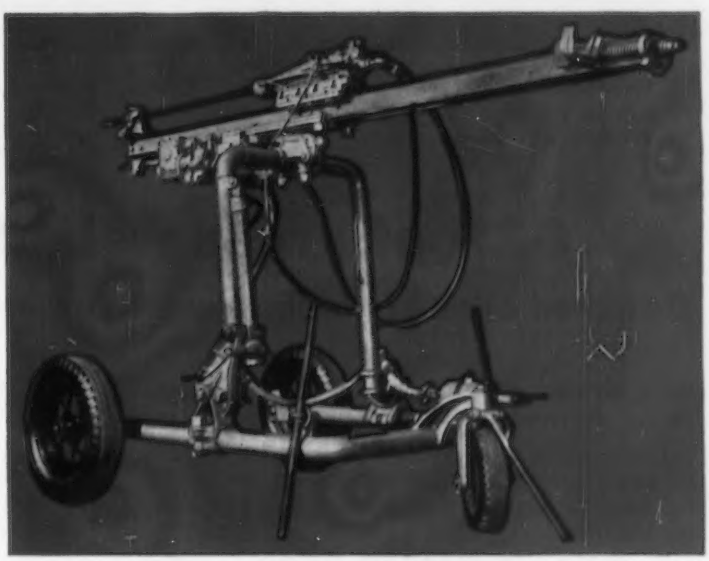
2 new more powerful Thor wagon drills!

General purpose SW-1 • Heavy duty BW-2

Now Thor offers two new wagon drills to fit every drilling requirement — wagon drills which will outperform and out-last other models. Drill holes in any direction, at any angle, on level or sloped ground. One man operation cuts costly man hours. Check these features on the new heavy duty BW-2 and the general purpose SW-1 and then call your Thor contractors tool distributor for a free trial of the model that fits your job.

THOR SW-1

Compact size—3 wheel reinforced rig • Weight with model 75 drifter—768 lbs. • 2 handle controls movable along mast • Handles up to 3½" bore drifter • New centralizer swings out of way for close drilling • Mast swings 360° vertical or horizontal • Wet or dry operation



THOR BW-2

5 h.p. rotary air motor • 3 wheel reinforced heavy-duty rig • Variable speed control • Motor and controls movable along mast • Wet or dry operation • Mast swings 360° vertical and horizontal • New centralizer swings out of way for close drilling • 800 to 1000 lbs. pulling power for steel removal • Spring buffer prevents chain breakage • Equipped with Thor 105 drifter. (4" bore)

Thor PORTABLE POWER TOOLS

THOR POWER TOOL COMPANY, AURORA, ILL.

Atlanta	Chicago	Detroit	Newark	St. Louis	Export Division,
Birmingham	Cincinnati	Houston	Long Island City, N.Y.	San Francisco	New York City
Boston	Cleveland	Los Angeles	Philadelphia	Seattle	
Buffalo	Denver	Milwaukee	Pittsburgh	Toronto Canada	

48,500 Pounds of payload yet this two-trailer hopper train weighs only 29,500 pounds empty.

The big capacity pays off for Motor Freight, Inc. of New Philadelphia, Ohio. This operator uses the equipment to haul coal under contract from mine to a plant 54 miles away.

Deadweight is cut by utilizing USS COR-TEN Steel, a high strength low alloy steel containing nickel, produced by United States Steel Corporation, Pittsburgh, Pa. COR-TEN provides 50% higher effective strength than structural carbon steel. Steels of this type give wide play to the skill of engineers.

62% of gross weight is payload!

Designed to utilize high strength low alloy steel containing nickel

"OUR FUTURE TRUCKS will be of the same material..." declares Robert Ress of Motor Freight, Inc.

Lightweight structures with stamina to withstand impact, battering and abrasion are readily fabricated from high strength low alloy steels containing nickel.

Also, when attacked by atmospheric corrosion, most steels of this type offer 4 to 6 times the resistance of structural carbon steel. As a result, the nickel alloyed steels retain a high degree of original strength over years of use.

Which means much more life per dollar invested.

What's more, use of high strength low alloy nickel steels increases revenue per ton mile. In either of two ways.

1. You can cut deadweight and increase payload without decreasing structural strength.
2. You can increase payload capacity without increasing total weight.

Take advantage of these modern metals. Design your equipment to earn more profit. Moderate in cost, high strength low alloy steels containing nickel along with other alloying elements are produced under a variety of trade names by leading steel companies. Learn more about these steels . . . send for a copy of "Nickel-Copper High Strength Low Alloy Steels." Do it now.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.

In 42 years of exclusive worm gear manufacture, including hob making experience, Cleveland has developed its engineering and production facilities to establish accurate duplication of parts as standard practice.

Photo shows typical hob and gear setup in a hobbing machine.

CLEVELANDS save you money on replacement parts

NOT once in a thousand times will this happen—but, with Cleveland you can order a new gear which will run correctly with an old worm that's still good after working perhaps 20 years or more. That's the kind of service you can expect from Cleveland—and here's why!

At the Cleveland factory are stored over 1,300 *different* worm gear hobs and master worms. This enables us to duplicate with precision any gear (or worm) that has *ever* left our plant. This means that if a gear *alone* should ever need replacement, you do not have to buy a complete new drive. Instead, just give us the particulars on your Cleveland speed reducer, no matter how old—10, 20, 30 or even 40 years! In short order, we'll have a new gear ready for you—one that will run perfectly with the older worm.

By supplying parts on this basis, Cleveland may be able to save you the cost of a *complete* new drive or the extra expense of special tooling. Isn't this the replacement protection you want when you buy worm gear drives? The Cleveland Worm and Gear Company, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

Here's a NEW Vibrating Profitable Production of

Every design and construction feature of the new Model "S" screen has been carefully calculated to provide outstanding performance at **lowest possible cost.**

Model "S"

screen handles feed up to 4 inches (coal up to 6 inches)

Need Help?

Not getting enough production? Production unbalanced? Too much waste? Regardless of your problem, you can get as much technical help as you *want or need* from Allis-Chalmers . . . a company with over a half century of experience in designing, building and applying reduction and classifying equipment for your industry.

Close Spacing of clamping bar bolts and proper camber provide added screen cloth life.

Vertical Angles add rigidity to side plates.

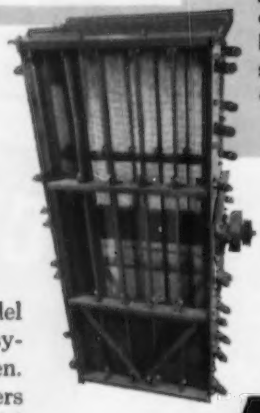
Replaceable full length buffer strips prevent metal-to-metal contact. Cushioning effect materially increases cloth life.

Self-locating Clamping Bar assembly holds cloth in position . . . accommodates cloth of any thickness. Full length support for hook strip simplifies installation of cloth.

NEW BULLETIN

tells how to select type and size of vibrating screen.

In addition to complete description of the Model "S" screen, Bulletin 07B8229 gives you an easy-to-understand procedure for selecting a screen. Get your copy from your nearby Allis-Chalmers representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

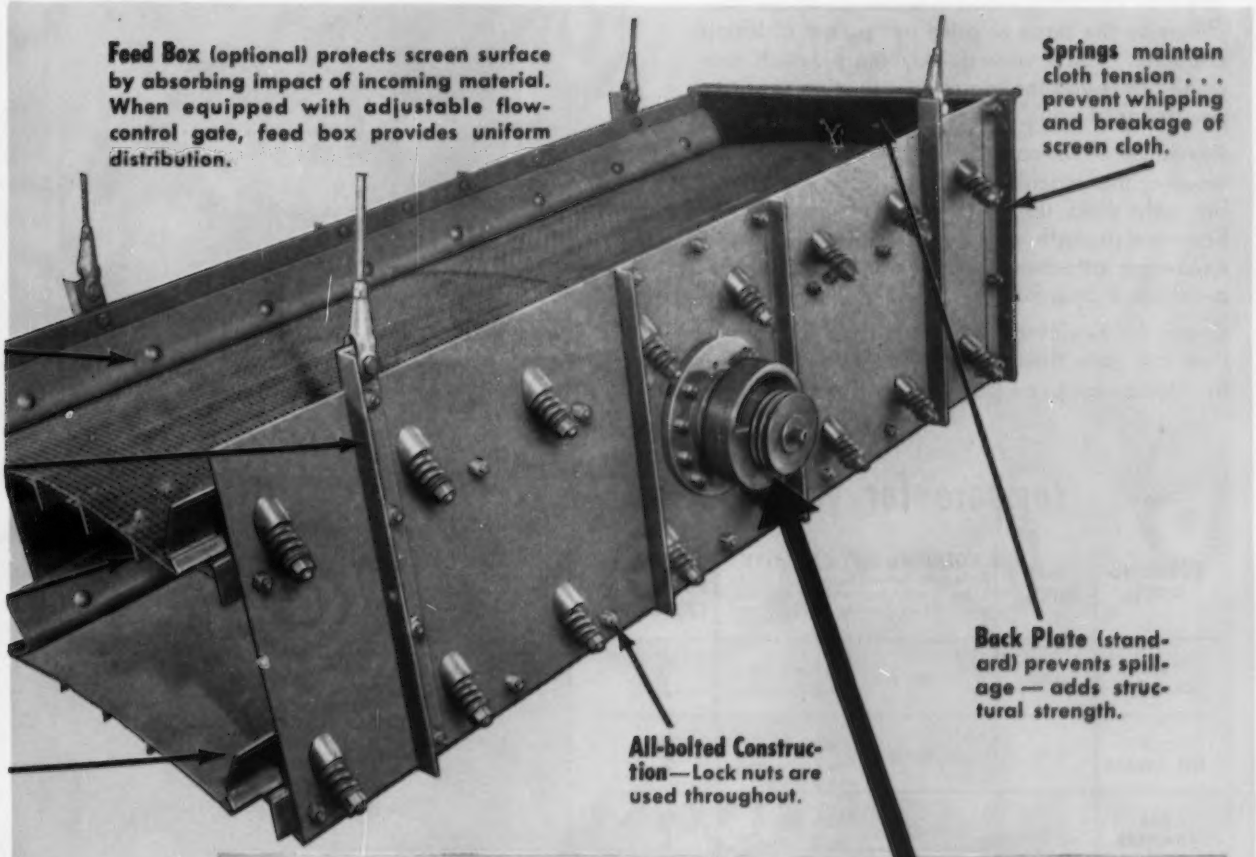


Sturdy Frame

1. Diagonal braces
2. Heavy channels
3. Replaceable cross members

ALLIS-

Screen . . . for Specification Aggregates


Feed Box (optional) protects screen surface by absorbing impact of incoming material. When equipped with adjustable flow-control gate, feed box provides uniform distribution.
Springs maintain cloth tension . . . prevent whipping and breakage of screen cloth.
Back Plate (standard) prevents spillage — adds structural strength.
All-bolted Construction—Lock nuts are used throughout.

Simplified Mechanism

- **Eccentric shaft** is enlarged and offset between bearings to provide major portion of throw. Distribution of off-center weight on both sides of bearing reduces shaft deflection and increases bearing life by equalizing bearing load.
- **Small counterweighted wheels** afford proper throw for screen surface selected.
- **Safe, sure method of lubrication** forces new grease into center of bearings, old grease out through labyrinth seals.
- **True running drive** extends belt life. Because the screen sheave is eccentric bored, the drive runs true . . . destructive whipping is prevented.

A-4916

CHALMERS A-C ALLIS-CHALMERS

Check

PRICE PER POUND OF LIFT CAPACITY

Here is a sound way to measure the value of excavators and cranes. Compare machines on the basis of price per pound of lifting capacity. You'll very quickly learn which machine offers you the biggest production capacity per dollar of equipment investment.

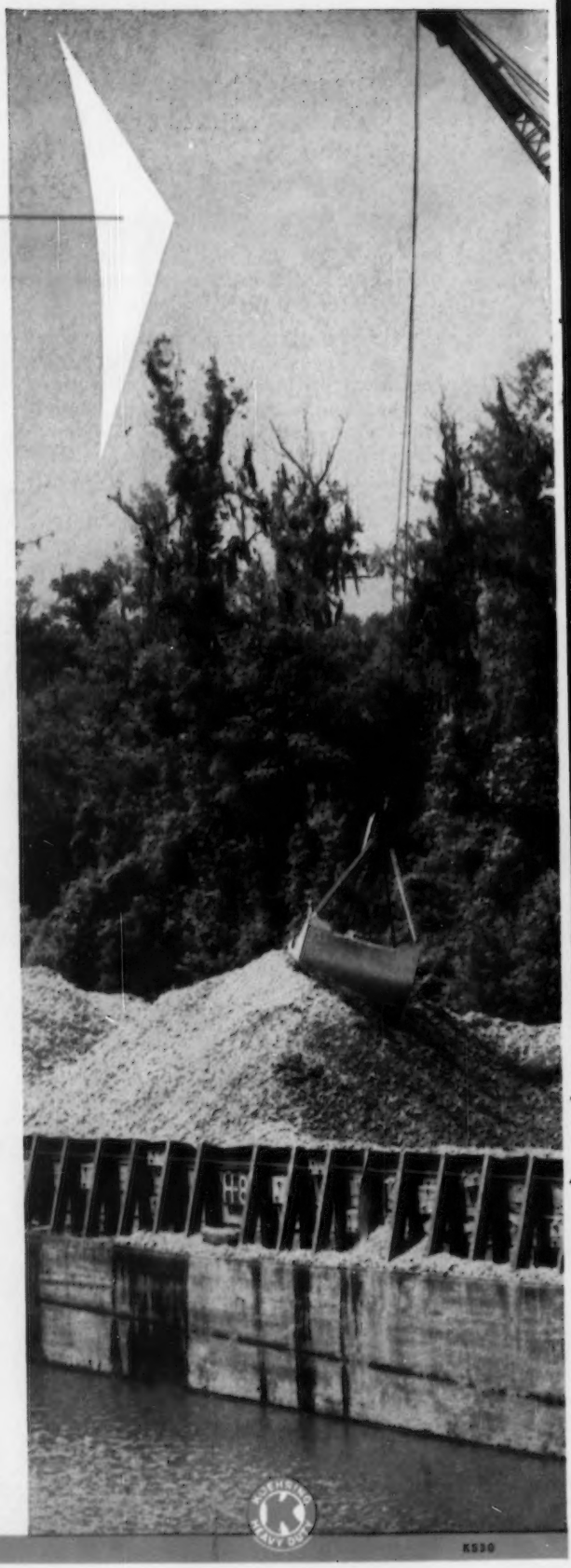
Remember — lift capacity is *work capacity*. Obviously, the machine with heaviest lift rating not only picks up larger crane loads. It also has more strength, speed and stability with every excavator attachment to handle bigger loads on a faster operating cycle.

Check the Koehring lift ratings shown below — then ask your Koehring distributor to give you the figures on price per pound of lift capacity.

compare for yourself:

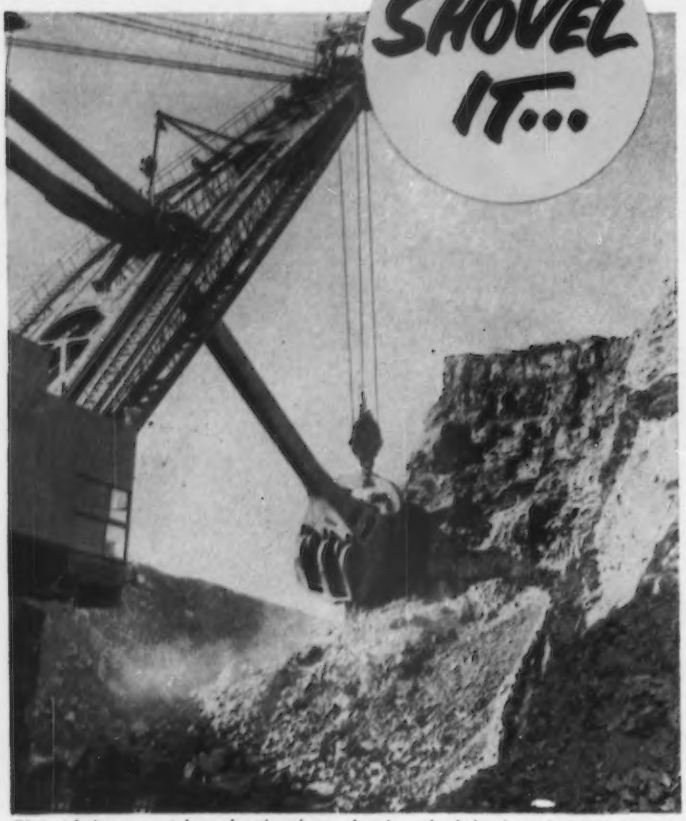
KOEHRING MODEL	SIZE DIPPER	KOEHRING LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load)		PRICE PER POUND OF LIFT CAP.*
205 CRAWLER	½-Yd.	20,000 lbs.	30-foot boom at 10-ft. radius	?
205 ON RUBBER	½-Yd.	30,000 lbs.	25-foot boom at 12-ft. radius	?
304 CRAWLER	¾-Yd.	27,800 lbs.	35-foot boom at 12-ft. radius	?
304 ON RUBBER	¾-Yd.	50,000 lbs.	30-foot boom at 10-ft. radius	?
405 CRAWLER	1-Yd.	40,000 lbs.	40-foot boom at 12-ft. radius	?
605 CRAWLER	1½-Yds.	72,300 lbs.	50-foot boom at 12-ft. radius	?
1005 CRAWLER	2½-Yds.	159,000 lbs.	50-foot boom at 12-ft. radius	?

Figures available on request—ask your Koehring distributor to see them.



KOEHRING COMPANY Milwaukee 16, Wis. Subsidiaries: JOHNSON • PARSONS • KWIK-MIX

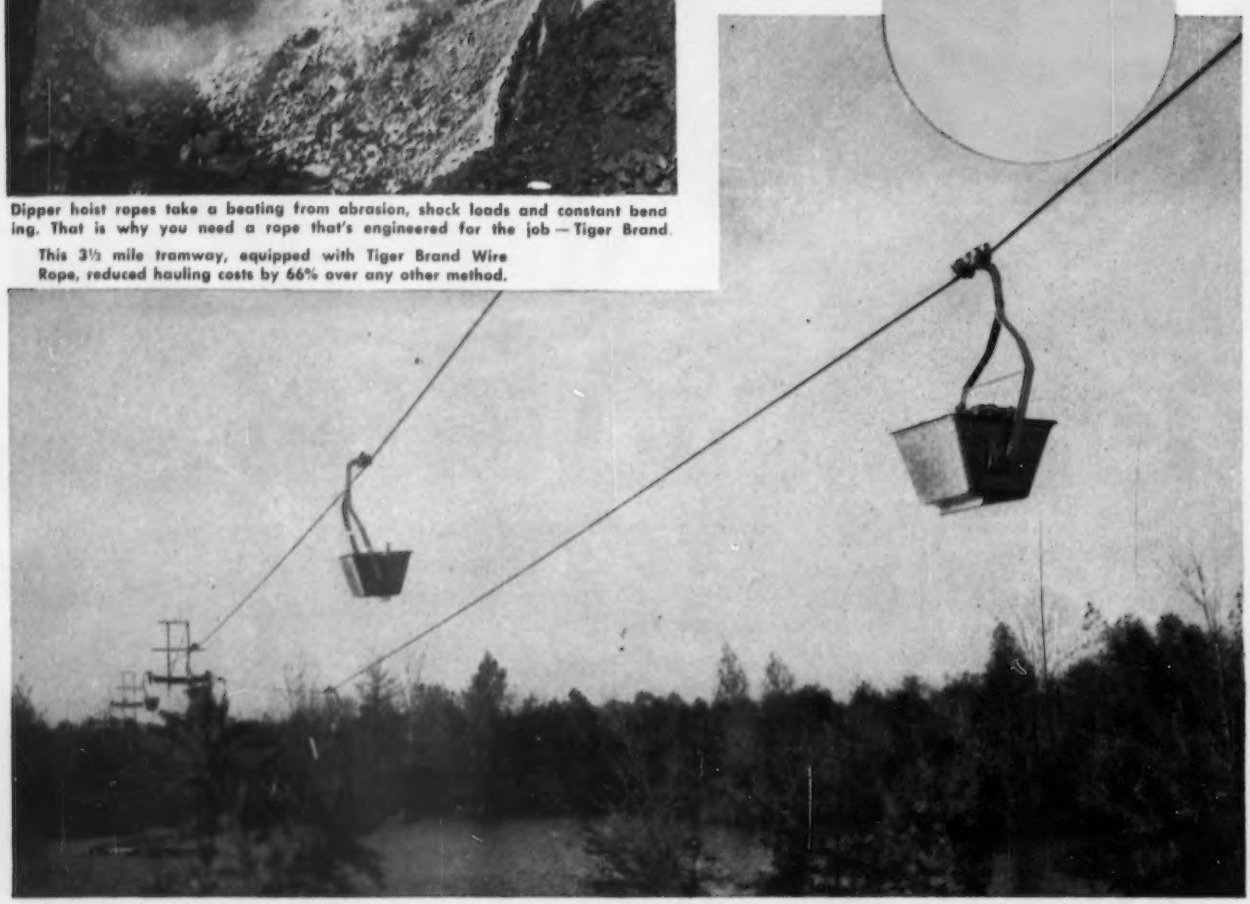
WHETHER YOU SHOVEL IT...



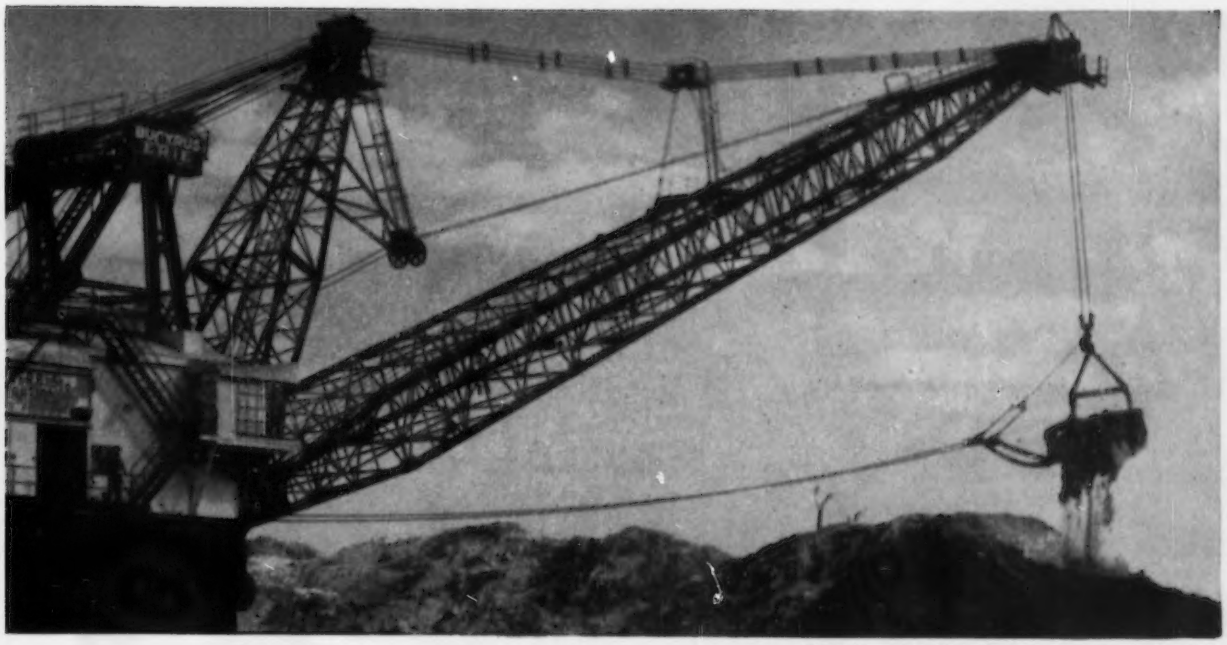
Dipper hoist ropes take a beating from abrasion, shock loads and constant bending. That is why you need a rope that's engineered for the job — Tiger Brand.

DRAG IT...

OR HAUL IT



This 3½ mile tramway, equipped with Tiger Brand Wire Rope, reduced hauling costs by 66% over any other method.



Tiger Brand Drag Lines have a reputation for keeping costs down by moving more cubic yards per rope.

BY AIR... Tiger Brand delivers top yardage per dollar spent for wire rope

When you are moving materials in a big way, the cost per cubic yard may be a deciding factor in the type of equipment and wire rope you select. Whether you use shovels, draglines or tramways, the problem is to pick the rope that will give the best possible service on your job.

On shovels, Tiger Brand Wire Rope has run up some amazing records. Tiger Brand shovel hoist ropes are designed to combine flexibility, strength and resistance to abrasive wear as required by this class of service.

On draglines, where a lot of abrasive wear and abuse are encountered, Tiger Brand drag ropes have demonstrated time and again that the right rope for the job is the most economical.

For tramways, Tiger Brand track cables and traction ropes are recognized leaders.

For a personal guide to rope selection, send the coupon.

American Steel & Wire Division
Rockefeller Building, Dept. C-26
Cleveland 13, Ohio

Please send me your Wire Rope Recommendation Book, "The Right Rope for the Job."

Name .....
Company .....
Address .....
City ..... State .....

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

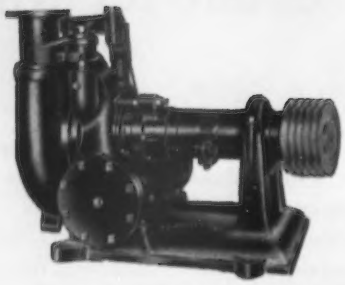
USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

UNITED STATES STEEL

THIS MODERN HIGHWAY FLOWED THROUGH WILFLEY PUMPS!



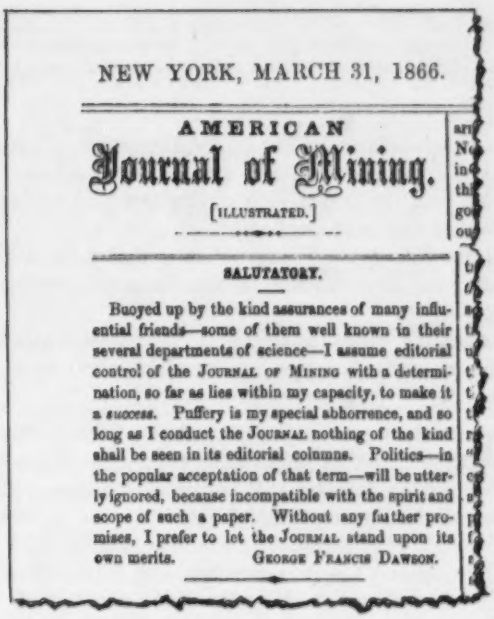
Many tons of the Portland cement for this important link in the transcontinental highway system were produced using Wilfley Sand Pumps. Wherever Wilfley Pumps are used, the record reveals stepped-up production and cost-saving efficiency. These famous pumps are synonymous with continuous, trouble-free, economical operation without attention. Let Wilfley solve your pumping problems. Individual engineering on every application. Write or wire for complete details.

Wilfley Acid Pump
"COMPANIONS IN ECONOMICAL OPERATION"
Wilfley Sand Pump

A. R. WILFLEY and SONS, INC.
Denver, Colorado, U.S.A. • New York Office: 1775 Broadway, New York City

ENGINEERING AND MINING JOURNAL

FEBRUARY 1956



NEW YORK, MARCH 31, 1866.

AMERICAN

Journal of Mining.

[ILLUSTRATED.]

SALUTATORY.

Buoyed up by the kind assurances of many influential friends—some of them well known in their several departments of science—I assume editorial control of the JOURNAL OF MINING with a determination, so far as lies within my capacity, to make it a *success*. Puffery is my special abhorrence, and so long as I conduct the JOURNAL nothing of the kind shall be seen in its editorial columns. Politics—in the popular acceptation of that term—will be utterly ignored, because incompatible with the spirit and scope of such a paper. Without any farther promises, I prefer to let the JOURNAL stand upon its own merits. GEORGE FRANCIS DAWSON.

E&MJ's 90th Year

NINETY YEARS AGO when George Francis Dawson wrote the first editorial in the first issue of the *American Journal of Mining* (subsequently *Engineering and Mining Journal*) he set down the foregoing aims quite candidly and simply.

Since then it has been the constant goal of *E&MJ* to serve the mining industry skillfully and faithfully. Objectives, policies and ethics of this publication have been handed down from one editorial staff to another through a succession of 12 editors—always with the knowledge that readers will only accept *E&MJ*'s contents if it is of such high quality that "the Journal will stand upon its own merits."

In recent decades, editors of the McGraw-Hill publications have been schooled in the philosophy of the late James H. McGraw, who had done so much to raise the standards and ethics of industrial journalism, and instill force and conviction in editorial writing. Here's his advice:

"First among such ideals (of industrial journalism) is independence—the determination of a journal to be its own master, to have no other guides for its opinions and policies but truth and the sound interest of the field it serves. Many men will try to bend its policy to serve their selfish interests, but the publisher who stands fast, who protects the integrity of his reading pages, will have the satisfaction of knowing that he has kept faith with his conscience and his readers, and that those whom he has courageously served will, by their support and confidence, crown his journalistic efforts with success."

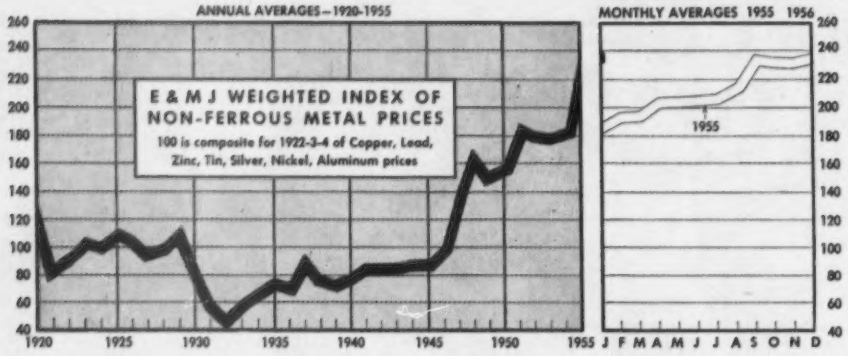
McGraw-Hill's concept of the reader's position is that "The reader is boss"—not in the sense that he tells the editor what to say, when to say it, or how to say it—but rather that what the reader wants to know or needs to know to do a better job is also of prime interest to the editor. Each year hundred's of *E&MJ*'s pages are written by readers who are authorities on some commodity or technical development. Note for instance in this "79th Annual Survey and Outlook" issue how many prominent members of the mining fraternity have contributed items to establish technical and economic industry perspective.

In retrospect we note that 90 years ago Editor Dawson forecast that "Compressed air, as a motor and medium for ventilating mines, has now been brought into practical and successful operation, and the day cannot be far distant when it will be in general use."

Again in 1941 on the occasion of *E&MJ*'s forward looking 75th anniversary issue, the mining forecaster noted a method of "melting a hole in the rock by application of intense heat" and that it might be adopted under conditions which are particularly favorable." Today, with jet-piercing firmly established, we are looking toward high-frequency rock penetration, thus illustrating the perennial progress that the technical press must always keep in its sights.

E&MJ OUTLOOK

PRICES



●

MARKETS

***E&MJ's* index moved upwards** from 236.88 for December to 239.45 for January because of increases in copper, lead and zinc prices which more than offset the steady decline in tin over the month. Fear buying and Lifo buying which pushed tin's price up at the year end have slacked off.

Aluminum experts keep their eyes on scrap prices to determine which way the market will go. The recent ½c drop in premium aluminum scrap prices is not considered significant.

What high copper prices can do to the aluminum vs copper competition is brought out forcefully in Simon Strauss's copper review which starts on p 82.

●

AT HOME

Be prepared to hang onto your good engineers. Industry is publishing newspaper ads by the page virtually begging for engineering talent, and the point has now been reached where the mining industry will be raided for men with basic engineering talent. See p 203 of the January issue of *E&MJ* for an indication.

U. S. Steel foresees a good year ahead. The company started 1956 with a backlog of orders totaling 6.69-million tons as compared with 3.86-million at the start of 1955. The automobile industry, which accounts for about 24% of the company's shipments, is expected to decline by only a few per cent over the year. Any steel released by auto manufacturers so far has been quickly picked up by other industries.

Cleveland-Cliffs and four steel companies will form a corporation to be called the Marquette Iron Mining Co. which will lease and operate the Empire and Republic mines in Michigan. Ore will be concentrated and pelletized.

The Office of Defense Administration has repealed its rule of August 11 denying fast write-offs on bauxite, cryolite, iron ore and titanium.

●

LABOR

The Mine-Mill-Teamster alliance vs Steelworkers' scrap may mean more headaches for mine managers. Two areas have already been caught in the cross-fire. See p 154.

Mine-Mill has decided to keep its nose out of the CIO-AFL jurisdictional feud at Kitimat because it recognizes the fact that raiding "is a demoralizing process that hurts the worker's interests."

●

ABROAD

French aluminum output in 1955 hit an all-time high of 129,175 tons. Iron ore production totaled 50.73-million tons.

Fresnillo Co. has purchased the Gibraltar mine which adjoins its holdings at Naica, Chihuahua, Mexico.

Tunisian mineral production for 1955 was as follows: lead, 42,907 tons; iron ore, 1,140,078 tons; phosphate, 2,200,745 tons.

A 250,000-ton iron ore deposit reported to run about 63% Fe has been discovered at Ajaltoun Montain, Jordan. Plans call for export of ore to Germany and Britain.

Major Non-ferrous Prices Rise; Copper Records Broken in 1955

JANUARY ECONOMIC ACTIVITY continued at a high rate though some observers believe we can expect no further increase in the near future. The Federal Reserve Board's index of industrial production for December was 144% of the 1947 average and will probably be the same for January. A decline in automobile output may be over emphasized. Statistics on automobiles and truck assemblies follow:

U. S.	1956 (a) Jan.	1955 Jan.	Dec.
Cars	612,000	660,000	683,000
Trucks	103,000	92,000	98,000
Totals	715,000	752,000	781,000
Canada	30,000	29,000	30,000
U. S. and Canada	745,000	781,000	811,000

(a) Estimate based on first four weeks.

The normal seasonal buying and production in the winter 1954-55 did not occur; buying and output were unusually heavy largely from postponed buying to get the 1955 models. If this year the normal seasonal is back, January 1956 activity should be exceptionally high and should give prospects close to 1955.

Non-ferrous metal prices rose in January to 239.45% of the 1922-24 average, 2.49 points above the December index as measured by the *E&MJ* non-ferrous price index. The rise reflects increases in copper, lead and zinc prices.

The top copper price received by regular sellers rose throughout the month. For the *E&MJ* week ending February 1 the top was 52.3¢ delivered. The top price in foreign markets was slightly under this. In late January nearby copper tightened considerably. London bid copper prices, for prompt delivery first session, showed range from £381 to £401—this is about 2½¢ per lb.

Stocks held by U. S. consumers continued to rise. The end of December stock figure was 389,974 tons. The comparable figure a year earlier was 360,526 tons. Consumers are so convinced of the instability of copper supply, largely because of strikes, that they are not satisfied with this level of stocks and may increase them further. Also, as a ratio of stocks to current operations, the figure is lower than most fabricators like. January stocks may not show an increase—many fabricators refrained from shipping products that otherwise would have been shipped owing to a need to keep stocks high for Lifo reasons in connection with tax matters. But producers did the same.

The copper supplying industry broke a number of records in 1955. Three new figures were set for the world: crude primary production, refined production and deliveries of refined copper to fabricators. These data for the world exclude WW II years, the data for which are uncertain. Deliveries of refined copper to U. S. fabricators was high but about 200,000 tons less than in 1943. The following statistics, based on Copper Institute data, show the maximum copper output and deliveries for any one year, and the 1955 figure.

United States

Production:	(c) Maximum	1955
Crude, primary	1,111,022 (a)	1,037,580
Crude, secondary	135,052 (b)	124,759
Totals	1,246,074	1,162,339
Refined copper	1,395,003 (c)	1,467,448
Deliveries, refined	1,643,677 (a)	1,439,758

World

Production:		
Crude, primary	2,399,192 (c)	2,614,271
Crude, secondary	145,293 (b)	133,064
Totals	2,544,485	2,747,335
Refined copper	2,515,069 (c)	2,728,219
Deliveries, refined	2,455,875 (d)	2,747,057

(a) 1943 (b) 1949 (c) 1953 (d) 1954
(e) Except, in some cases, 1955.

The strike which began in Chile on December 14 ended early in January. Perhaps 30,000-34,000 tons were lost. On January 10 the Phelps Dodge refinery at Laurel Hill was struck. Reports at the time indicated it was an "unauthorized" strike and many believed it would be over in a few days. On February 2 it was still on; a dispute appears to have arisen between the local union and the national union. This often complicates settlement. About 450 tons of copper are being lost each day.

Lead prices in the U. S. rose by ½¢ a lb on January 4 to 16½¢ N. Y. A major smelting company had put the price up. This increase reflected the real strength in the lead market here and in Europe Europe had appeared exceptionally strong and prices there were high enough to divert lead that ordinarily would come to the U. S., tightening the U. S. market. But some sellers felt the London market was too erratic and too much subject to non-metal speculation to use as a guide for U. S. prices. Their notion apparently was correct. London lead started down and fell about 2¢ below the price at the time the U. S. price rose to 16½¢. With the U. S. import duty of 1.06¢ and a shipping cost of about 0.75¢ added to the London price, the latter rose to about 18¢ on January 4; by January 17 it was down by about 2¢. Most sellers and consumers felt and still feel the lead position is strong. The talk about a cutback in economic activity in the U. K., along with tightening credit conditions in connection with anti-inflationary measures by the Government, probably led speculators to get out of the market. The slight drop in fabricator use of lead, most factors suggest, has had little effect on the statistical position.

GSA came into the market for lead late in January. Most feel the GSA action puts a floor under the price and that we can expect a 16¢ price to remain for some time. In London lead spot prices moved up from the low of January 17 by about 1¢. In part, this reflects the strike of Australian dock workers; by the last of the month the strike had not been settled.

Zinc was raised by ½¢ a lb by a major custom smelter on January 6. Demand conditions had been strong enough to permit this for some time and nearly everyone expected it. Prices outside the U. S. had been high enough to permit this and some zinc normally coming here could profitably be diverted elsewhere. The price was firm at the end of January and GSA buying, many factors held, guaranteed this as a minimum.

In 1955 several records were broken by the zinc industry. Data below derived from American Zinc Institute statistics compare the past three years:

Stock at beginning	1953 87,160	1954 180,843	1955 124,277
Output	971,191	868,242	1,031,012
Output, d.s.	2,661	2,379	2,825
Shipments:			
Domestic	818,850	787,922	1,007,619
Export & drawback	16,326	27,929	19,496
Government	42,332	108,957	87,200
Totals	877,508	924,808	1,114,316
Stock at end	180,843	124,277	40,979
Unfilled orders	35,466	45,862	72,908

Galvanizing was still the major user of zinc with about 430,000 tons consumed for this purpose in 1955; diecasting took about 380,000 tons. Diecasting use rose about 37%. Galvanizing rose only about 8% but the 1954 galvanizing figure was high relative to other uses so this 8% increase is deceptively small.

Aluminum in the U. S. continues almost as tight as ever. There is little prospect of this changing in the first half of the year. Most observers expect it to last throughout the year. Secondary prices dropped a little but they are still about 6¢ above primary prices. The water shortage in parts of Canada has cut back Alcan output and deliveries to the extent it does not expect to catch up with its commitments to the U. S. before next year. U. S. primary output in December made a new record—140,748 short tons.

Quicksilver prices dropped from about $275 to about $270 during the month. Much European metal has been coming into the U. S. market. Late in the month there were reports some heavy shipments from Spain were being delayed.

E&MJ Weighted Index of Non-Ferrous Metal Prices

100 is composite for 1922–3–4. (Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum).

1942	86.80	1949	151.97
1943	88.74	1950	156.42
1944	88.74	1951	190.16
1945	90.86	1952	183.33
1946	110.06	1953	180.29
1947	149.46	1954	185.91
1948	168.38	1955	214.79

MARKETS (*Continued*)

Average Prices January (E&MJ Quotations)

Copper:	
Electrolytic, domestic refinery	43.749
Electrolytic, export, refinery	45.562
Lead:	
Common, New York	16.151
Common, St. Louis	15.960
Silver and sterling exchange:	
Silver, New York, per oz.	90.357
Silver, London, pence per oz.	78.267
Sterling Exchange, "Checks"	280.662
Zinc:	
Prime Western, East St. Louis	13.431
Prime, Western, delivered (g)	13.931
Tin:	
New York Straits	104.820
New York, 99% min. (e)	103.820
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$273.040
Antimony (*E&MJ*) (d)	36.470
Antimony, bulk, Laredo	33.000
Antimony, in cases, Laredo	33.500
Platinum, refined, per oz.	$103.560
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	24.400
Magnesium, ingot	32.500
Nickel (f)	64.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Trade volume rose 27% in January. European turnovers were large, with transactions in Paris reaching their highest level in four years. Free gold markets were reopened in Greece and in Belgium. Central and South American trading was active, due to new currency unrest. Coin prices dropped in Brazil and Argentina but rose in Chile. Asiatic markets were moderately active. No Soviet sales were reported. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Dec. 31	Jan. 31	Dec. 31	Jan. 31
NEW YORK, transit	.....	.....	$35.05	$35.08
MANILA	$40.25	$40.50	36.50	36.25
HONG KONG	40.75	41.00	37.85	37.88
BOMBAY	51.75	52.50	50.75	51.25
TANGIER	40.00	41.60	35.00	34.95
BEYROUGH	40.85	42.05	35.12	35.12
PARIS	42.10	42.50	35.85	35.95
BUENOS AIRES	38.25	38.25	35.35	35.55

Note: Prices are computed at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

Jan. 1956	Electrolytic Copper (a) Domestic	(b) Ex-Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Tin Straits New York
2	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
3	43.850	44.075	16.000	15.800	13.500	13.000	22.500	108.875
4	43.575	44.925	16.270	16.300	13.500	13.000	22.500	108.500
5	43.075	45.325	16.500	16.300	13.500	13.000	22.500	107.500
6	43.750	45.775	16.500	16.300	13.764	13.264	22.500	106.750
7	No Market	45.775	16.500	16.300	14.000	13.500	22.500	106.750
9	43.450	45.650	16.500	16.300	14.000	13.500	22.500	106.750
10	44.925	45.750	16.500	16.300	14.000	13.500	22.500	106.250
11	43.575	45.100	16.500	16.300	14.000	13.500	22.500	106.125
12	43.250	45.325	16.500	16.300	14.000	13.500	22.500	105.750
13	44.675	45.750	16.000	15.800	14.000	13.500	22.500	105.375
14	No Market	45.750	16.000	15.800	14.000	13.500	22.500	105.375
16	43.575	46.225	16.000	15.800	14.000	13.500	22.500	104.500
17	44.400	44.800	16.000	15.800	14.000	13.500	22.500	104.250
18	43.625	46.225	16.000	15.800	14.000	13.500	22.500	104.875
19	43.950	45.525	16.000	15.800	14.000	13.500	22.500	104.750
20	43.975	45.550	16.000	15.800	14.000	13.500	22.500	104.125
21	No Market	45.550	16.000	15.800	14.000	13.500	22.500	104.125
23	43.925	45.850	16.000	15.800	14.000	13.500	22.500	103.625
24	43.800	45.125	16.000	15.800	14.000	13.500	22.500	103.500
25	42.775	45.325	16.000	15.800	14.000	13.500	22.500	103.000
26	43.525	46.500	16.000	15.800	14.000	13.500	22.500	101.875
27	44.300	45.350	16.000	15.800	14.000	13.500	22.500	102.500
28	No Market	45.350	16.000	15.800	14.000	13.500	22.500	102.500
30	43.475	45.150	16.000	15.800	14.000	13.500	22.500	101.750
31	43.275	47.325	16.000	15.800	14.000	13.500	22.500	101.125
AVERAGES FOR MONTH								
Jan.	43.749	45.562	16.151	15.960	13.931	13.431	22.500	104.820
AVERAGES FOR WEEK								
Jan.								
4	43.675	45.570	16.054	15.900	13.500	13.000	22.500	108.225
11	43.755	45.563	16.500	16.300	13.877	13.377	22.500	106.688
18	43.905	45.679	16.083	15.883	14.000	13.500	22.500	105.021
25	43.685	45.488	16.000	15.800	14.000	13.500	22.500	103.854
CALENDAR WEEK AVERAGES								
Jan.								
7	43.563	45.175	16.354	16.200	13.653	13.153	22.500	107.675
14	43.975	45.554	16.333	16.133	14.000	13.500	22.500	105.938
21	43.905	45.646	16.000	15.800	14.000	13.500	22.500	104.438
28	43.655	45.583	16.000	15.800	14.000	13.500	22.500	102.833

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Jan. 1956	Silver (c) New York	Silver London	Sterling Exchange "Checks"	Gold London	Gold (d) United States
2	Holiday	78.750d.	Holiday	249s. 5¾d.	Holiday
3	90.500	78.750d.	280.3616	249s. 5d.	$35.00
4	90.500	78.750d.	280.4062	249s. 6d.	35.00
5	90.500	78.750d.	280.4062	249s. 5¾d.	35.00
6	91.000	78.750d.	280.5625	249s. 6d.	35.00
7	(e)	(e)	(e)	(e)	35.00
9	90.500	78.875d.	280.7901	249s. 3¼d.	35.00
10	90.500	78.875d.	280.6294	249s. 3d.	35.00
11	90.500	78.875d.	280.6160	249s. 3¼d.	35.00
12	90.500	78.875d.	280.6785	249s. 3¼d.	35.00
13	90.500	78.750d.	280.7500	249s. 3d.	35.00
14	(e)	(e)	(e)	(e)	35.00
16	90.500	78.250d.	280.6875	249s 2¾d.	35.00
17	90.500	78.000d.	280.6875	249s. 3½d.	35.00
18	90.500	78.000d.	280.7723	249s. 2½d.	35.00
19	90.500	78.000d.	280.8883	249s. 2d.	35.00
20	90.500	78.000d.	280.8125	249s. 1½d.	35.00
21	(e)	(e)	(e)	(e)	35.00
23	90.000	78.000d.	280.7812	249s. 2d.	35.00
24	90.000	77.750d.	280.6041	249s. 2¾d.	35.00
25	90.000	77.750d.	280.6562	249s. 3½d.	35.00
26	90.000	77.750d.	280.6651	249s. 3¾d.	35.00
27	90.000	77.500d.	280.7500	249s. 3¼d.	35.00
28	(e)	(e)	(e)	(e)	35.00
30	90.000	77.500d.	280.7500	249s. 2½d.	35.00
31	90.000	77.375d.	280.6473	249s. 3d.	35.00
AVERAGES FOR MONTH					
Jan.	90.357	78.267	280.662	—	35.00
AVERAGES FOR WEEK					
Jan.					
4	90.500	—	280.312	—	35.00
11	90.600	—	280.601	—	35.00
18	90.500	—	280.715	—	35.00
25	90.200	—	280.748	—	35.00

Calendar Week Averages: New York Silver: Jan. 7th, 90.625; 14th, 90.500; 21st, 90.500; 28th, 90.000.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 pounds.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

London Metal Exchange Quotations

Jan.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
2	396	398	389	390	120	120½	118½	119	101½	101¾	98¾	99	832½	833	814	815
3	398	399	390½	391½	122	122¼	119¼	120	103	103½	100	100½	848	850	821	822
4	394½	395	386½	387	126¼	126½	123¼	123½	105	105¼	101¾	102	844	845	820	821
5	394½	395	385½	386	124¼	125	122	122¼	105	105¼	102	102¼	837½	840	815	816
6	388	390	381	381½	122¾	123	120½	121	104½	104¾	101½	101¾	827½	830	808	809
9	393	393½	384½	385	121	121½	118¾	119	103½	104¼	100½	100¾	830	831	813	814
10	385	385½	377½	378½	119½	119¾	117½	118	101½	101¾	98¾	99	820	825	806	807
11	381	381½	372	373	116½	117	115¼	115½	100	100¼	97¾	98	812½	815	802	803
12	385	386	374½	375	117¼	117¾	116	116¼	100¾	101	97½	98	816	817	803	804
13	304	395	379	380	115¾	116	115	115¼	99¾	100¼	97	97¼	818	821	803	804
16	386½	387	373	374	111½	111¾	111¼	111½	96½	97	93½	94	815	817	796½	798
17	387½	388	370	371	111	111½	110¾	111	97	97⅛	94¾	95	811	812	792	793
18	394	395	375	376	114¼	114½	113	113½	99½	99¾	96	96¼	810	811	795½	796
19	392	393	373½	374½	116¾	117	115¼	115½	99½	100	96¼	96½	817½	818	801½	802
20	391	392	373	373½	116¾	117¼	115	115¼	98½	98⅝	95½	95¾	810	811	796½	797
23	396	396½	377	377½	120¼	120½	117	117¼	99¼	99½	96	96¼	803	805	791	793
24	398	399	378½	379½	120½	121	117¼	117½	100	100¼	97	97¼	804	805	792	793
25	401	402	380	381	119½	120	116¾	117	100	100¼	97	97¼	800	802	790	791
26	390	391	374	375	117½	118¼	115	115¼	100¼	100½	96¾	97	784	785	776	777
27	387½	388½	374	375	116½	116¾	114¼	114½	99¼	99½	95¾	96	790	791	780	781
30	388	390	374	375	116¼	116½	113¼	113½	99	99¼	95¼	95½	784	785	775	776
31	398	399	380	381	118	118¼	114½	115	101¼	101½	96	94¼	780	782	768	770
Av'g's	£392.227			£378.693		£118.568		£116.500		£100.835		£97.659		£814.216		£798.659

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted.

MISCELLANEOUS METALS

Jan. 31, 1956

Aluminum ingot, 99 plus % lb			24.4¢
Antimony, spot, lb, less than carload in cases			36.47¢
In bulk, carload lots, f.o.b. Laredo			33.00¢
Bismuth, ton lots, lb			$2.25
Cadmium, commercial sticks, delivered, lb			$1.70
Calcium, lb, ton lots 98% cast			$2.05
Chromium, 97% grade, lb, contract			$1.25
Cobalt, 97 to 99% per lb			$2.60
Germanium, per gram, 10,000 gram lots	44½¢	@	48½¢
Indium, troy oz			$2.25
Lithium, lb, 98%	$11.00	@	$14.00
Nickel, cathodes lb, f.o.b. Port Colborne (a)			64½¢
Magnesium, 99.8%, carloads, lb, producer's plants, Freeport, Texas			32½¢
Palladium, troy oz	$23.00	@	$24.00
Platinum (wholesale lots) troy oz	$97	@	$112
Quicksilver, flask of 76 lb. 25 flasks or more	$270	@	$274
Selenium, 99 plus %, lb. (Feb. 1)			$13.50
Silicon, minimum 97%, carloads, lb			20½¢
Tellurium, lb	$1.50	@	$1.75
Thallium, 100 lb or more, lb			$12.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb			(b)$3.45

(a)Includes U. S. duty. (b)Effective Nov. 23, 1955.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$38.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$23.50	@	$24.50
48% Cr_2O_3 3 to 1 ratio	$44.00	@	$53.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.25
Mesabi bessemer			$11.10
Mesabi, non-bessemer			$10.95
Lead (Galena), 80%, Joplin, Mo., ton			$201.32
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties $1.16 @ $1.20 c.i.f. U. S. ports, duty extra. Long-term contract nominal.			
Molybdenum Ore, 90%, per lb of Mo f.o.b. mines	$1.10	@	$1.15
Columbium-Tantalum, per lb, combined oxides			(a)
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$33.50	@	$34.00
Domestic, scheelite, 60% f.o.b. mill			$63.00
Vanadium Ore, per lb of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$84.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb in bbl carload lots delivered			5¼¢
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb	$1.96	@	$1.97½
Copper Sulphate, 100 lb			$14.90
Germanium Oxide, gram			27½¢
Molybdic trioxide, technical, per lb of Mo	$1.30	@	$1.33

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4–9% C)			26½¢
Ferromanganese, 74 to 76%, per lb., shipg. pt			10.25¢
Ferromolybdenum, 55 to 65% Mo, lb of Mo contained	$1.54	@	$1.66
Ferrosilicon, 50% per lb of Si f.o.b. shipping point			12¾¢
Ferrotungsten, 72 to 82%, lb of W contained (eff. Feb. 1)			$3.45
Ferrovanadium, per lb of V delivered	$3.10	@	$3.45
Silicomanganese, max. 1½% carbon lb, contracts			11.5¢
Spiegeleisen, per long ton, 19 @ 21% grade			$91.50

NON-METALLIC MINERALS

December 1955

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$1,400	@	$17.25
Crude No. 2	$700	@	$1,100
Spinning fibers	$350	@	$650
Shingle fibers	$172	@	$210
Paper stock	$114	@	$137
Waste			$84
Shorts	$35	@	$75
Asbestos, f.o.b. Vancouver, B. C. (U. S. funds):			
Spinning fiber	$460	@	750
Shingle fiber	$165	@	$300
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$353	@	$383
Shingle stock	$172	@	$190
Paper stock	$114	@	$145
Waste, stucco or plaster			$82
Refuse or Shorts	$39	@	$72
Barytes f.o.b. cars:			
Georgia, crude, per ton			$15.00
Missouri, 94% $BaSO_4$, per short ton			$14.25
Bauxite, long ton, f.o.b. point of shipment:			
Domestic crude, 50 to 52% (not dried)	(a)$5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	@	$18.50
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.25
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$35.00	@	$36.00
60% effective CaF_2	$30.00	@	$28.50
Acid 97% concentrate, bulk, ton			$47.50
Fuller's earth, f.o.b. Georgia or Florida ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$40.00
Mica—Domestic, f.o.b. mines. Punch 12 to 22¢ per lb according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to 85¢; 2 x 2 inch, $1.10 to $1.60; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$30.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, prime, Texas, mines, long ton			$26.50
Talc, f.o.b. works, ton:			
New York, purified	$18.50	@	$20.00
Vermont, extra white			$13.50
Tripoli, Missouri, ton:			
40 mesh cream colored			$30.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$58.50
Steel f.o.b. Pittsburgh, billets, net ton			$68.50
Structural shapes, Pa., Ala. etc., 100 lb	$4.50	@	$4.60

THIS MONTH IN MINING

Daniel P. Eigo

Pitkin Receives Ore-Buying Contract

Sampling Firm Will Run AEC Depots; More Western Groups Apply for Mill Approvals

OPERATION of AEC uranium ore-buying and concentrate-receiving depots, in the hands of American Smelting & Refining Co. since 1948, was taken over on Feb. 1 by Lucius Pitkin, Inc., a firm of metallurgical chemists and consultants with headquarters in New York.

Contract to handle the functions in all states west of the Mississippi is on a cost-plus-fee basis. Martin N. Gaines, who has been project manager for AS&R since the program began, has been employed by Pitkin to direct operations after the changeover. Operations involve "receiving, weighing, sampling and assaying concentrates and planning and executing administrative, clerical, technical and other necessary duties." Headquarters will remain at Grand Junction.

AS&R notified the Commission some months ago that it would withdraw at the expiration of its most recent contract, Dec. 31, 1955, but agreed to continue operating another month after that date when no successor had been chosen by AEC. Eight firms submitted bids to take over the program.

Lucius Pitkin, new contract holder, is a long-established firm with some 70 years' experience in sampling and processing fields. Firm is also experienced in sampling and analysis and worked with AEC's Raw Materials Division previous to signing the new contract. Officers of the company include Dr. Robert H. Bell, president; Frederic H. Wright, vice president; and Erskine B. Mayo Jr., secretary and treasurer.

Stations to be operated are the ore-buying stations at Monticello, Marysvale, Moab and White Canyon, Utah; Edgemont, S. D.; Globe and Tuba City, Ariz.; Riverton, Wyo.; and Grants, N. M. —plus the concentrate sampling plant and assay laboratory at Grand Junction.

AS&R officials, discussing the termination of their operations on the behalf of AEC, emphatically deny that the move was made in order to avoid future "conflict of interest" (which would imply that the firm was entering the uranium milling field) and say that the contract is being terminated because they have performed the services which they promised to perform. AS&R says, in effect, "we signed a contract to perform a service and we have fulfilled that contract."

Competition for construction of uranium mills in Utah, Colorado and Wyoming is growing in intensity, observers deduce from reports by Grand Junction Operations Office of Atomic Energy Commission.

Erection of at least six new mills in Utah and expansion of an existing mill at Salt Lake City have been proposed, the AEC confirmed.

Additionally, the commission confirmed and a number of proposals have been submitted in a "completed form" for new or expanded mills in Colorado and Utah.

Other proposals are in various stages of conversation or negotiation with AEC, says Sheldon P. Wimpfen, out-going manager of the Grand Junction center.

Among those submitting the so-called "complete" proposals for mills in this state are: New-Shat-Tex Corp. (Newmont Mining, Shattuck-Denn, the Texas Co.) for a mill at Medicine Hat, San Juan County;

Four Corners Uranium Corp. and Union Carbide (Nuclear) both at Green River, Utah. Nuclear Metals Corp. of Denver, Colo., at White Canyon district, San Juan County.

The following firms have discussed or are in various stages of negotiations with the Commission for mills:

Vitro Corporation of America, 70% expansion at Salt Lake City; Atlas Corp. and/or Floyd B. Odlum, Big Indian District, San Juan County; National Mining & Milling (Happy Jack mine optioners), White Canyon District, San Juan County;

Lucky Mc Uranium and Utah Construction Co., Gas Hills District, Fremont County, Wyo.

In Colorado, "complete" proposals have been presented AEC by the following:

Union Carbide, expansion of its Rifle, Colo. mill; Expansion of the new Trace Elements, Inc., mill at Maybell, Colo.; Atomic Fuel Extractions Corp., mill at Bedrock, Colo; Gunnison Mining Co., new mill at Gunnison, Colo.

Publicity on the matter caused Wimpfen to announce that presentation of any list does not indicate approval or disapproval of any proposal, complete or incomplete.

AEC says as a result of the expansions and new construction last year, the uranium milling rate at the end of 1955 was five times the average 1952 milling rate.

There were nine processing mills operating in 1955 as follows: the Union Carbide Nuclear Co.'s mills at Rifle and Uravan; the Vanadium Corp. of America's mills at Durango and Naturita; Climax Uranium Co. at Grand Junction, all Colorado; Kerr-McGee Oil Industries, Inc., at Shiprock; Anaconda Co. at Grants, both New Mexico; Vitro Uranium Co. at Salt Lake City; and the Government-owned mill at Monticello, Utah.

The four new mills now in various stages of construction are at Edgemont, by Mines Development, Inc.; at Moab, by Uranium Reduction Co.; at Tuba City, Ariz., by Rare Metals Corporation of America; and at Maybell, Colo., by the Trace Elements Corp. A contract for a fifth new mill at La Sal, Utah, was signed Nov. 28, 1955, with Continental Uranium, Inc., of Grand Junction.

Mines Development, Inc. began construction of their mill at Edgemont in September 1955 with completion scheduled in about 10 months. Mill will provide processing facilities for the uranium ores of the Black Hills region, including current ore production which had been stockpiled at the Government-owned ore-buying station at Edgemont, in operation since the latter part of 1952. Uranium Reduction mill at Moab is expected to be finished in the mid-summer of 1956, while the Tuba City plant of the Rare Metals Corporation of America is scheduled for completion in the spring or early summer of 1956.

As a measure of the expansions in existing plants, enlargement of facilities was completed in 1955 at the Naturita mill of VCA, and at the Grand Junction plant of Climax Uranium. Vitro Uranium at Salt Lake City completed certain alterations which permitted an increase in plant production. At the Government-owned plant at Monticello, alterations in the old plant and construction of a new unit, both of which went into operation before the end of 1955, increased the plant's capacity nearly five times. At Bluewater, near Grants, Anaconda completed an expansion doubling its carbonate leaching plant and also started up a resin-in-pulp circuit to treat sandstone ores. Most uranium plants improved metallurgy as well as increasing capacity last year.

Orphan Claim Will Mine Uranium in Grand Canyon

A PRIVATELY-OWNED uranium claim in Grand Canyon National Park may prove out more than 100,000 tons, says Golden Crown Mining Co., a subsidiary of Western Gold & Uranium Inc.

The "Orphan claim," which is reached via an aerial tramway down the slope from the South Rim of the canyon, is the only privately-owned land within the park; President Theodore Roosevelt signed a patented land claim in 1906 granting the 20-acre plot to Daniel Hogan, a former Rough Rider who believed the site contained copper ores. Mining operations by Golden Crown will not begin until Spring.

The new claim owners estimate the strike to hold "at least 100,000 . . . and possibly 300,000 tons of marketable ore."

Ore is a stovepipe formation, extending up and down from the outcrop on the slope, says the company.

Golden Crown had mining rights on the claim several years ago, but drilling had to await construction of the aerial tram. Firm was able to utilize Hogan's old adit as a drilling base; the former Rough Rider discontinued his work when the copper proved too low in grade. The claim is two miles west of the Bright Angel trail. Land was patented two years before the national monument was established.

According to Ralph G. Brown, president, chemical assays of drill samples have run "as high as 3.13% uranium oxide." Deepest hole to date is 217 ft, and is "still in the mineralized area." A 53-ft section contained ore assaying 1% oxide. Ore is pitchblende.

Company plans to truck ore from the Orphan to the Tuba City ore-buying station, 85 miles away.

Nevada Mining Association Names New Officers, Board

ANNUAL MEETING of the Nevada Mining Association was held in Reno Jan. 9, 1956. Association named nine regular members of the group to serve on the Board of Directors for the coming year and also elected new officers. The group also chose an honorary president, John C. Kinnear Jr., general manager of Kennecott Copper Corp.'s Nevada mines division at McGill.

Officers elected for 1956 were: Norman E. Hanson, assistant to the president of Basic Refractories Inc., Gabbs, president; F. A. McGonigle, general manager and vice president of Manganese Inc., Henderson, first vice president; Roy A. Hardy, consulting engineer, Getchell Mines, Inc., Golconda, second vice president; and Louis D. Gordon, executive secretary. All elected officers were also made members of the board of directors, as were the following: L. N. Grindell, Nevada manager, U. S. Lime Products, Corp., Henderson; A. E. Millar, general manager, Anaconda Co. Yerington Mine, Weed Heights; Charles H. Segerstrom Jr., president, Nevada - Massachusetts Co., Tungsten; J. J. Strutzel Jr., vice president and general manager, Wah Chang Mining Corp., Bishop, Calif.; and S. H. Williston, vice president, Cordero Mining Co., McDermitt.

Spokane Mill Planned

NEWMONT MINING CO. has hired an engineering firm to study and design a uranium processing plant for the Spokane area, where Newmont operates the Midnite Uranium on the Indian Reservation.

Announcement of the mill project was made by Sen. Henry M. Jackson, Joint Committee on Atomic Energy.

As we went to press . . . .

Due this month is output from Giant Yellowknife's $500,000 mill addition at Yellowknife, N.W.T. P. N. Pitcher, general manager, says new addition will raise output by 2 or 3%. Gold production at the mine in the calendar year 1955 was more than $6-million.

Garfield Chemical and Manufacturing Co. will complete its $2,750,000 additional fifth unit to its sulphuric acid plant at Garfield, Utah, in the fall of this year. Company is an affiliate of American Smelting & Refining Co. and Kennecott Copper Corp.

Leonard Construction Co., subsidiary of Monsanto Chemical Co., is erecting the 250-tpd unit, which will boost total output of sulphuric plant to 1,000 tpd. Two new scrubbers and four mist Cottrell precipitators are being added to the smoke-cleaning plant in connection with the expansion.

Added H_2SO_4 production derived from sulphuric dioxide produced from AS&R's copper smelter, will go toward expanded needs of Western Phosphates, Inc., triple superphosphate plant, uranium mills on the Colorado Plateau, battery makers, oil refineries, steel picklers and tungsten refineries.

Metal & Thermit Corp., New York, has purchased an 800-acre tract in Virginia and will begin construction soon on a plant for "mining and processing titanium-bearing ore," says H. E. Martin, president of the firm. Completion of the plant is set for autumn of this year.

Property, located some five miles west of Montpelier, Va., is a source of both rutile and ilmenite ore, according to the company.

Acquisition of a 90-day option to purchase mining and milling rights for copper ore in the Lisbon Valley, Utah, have been announced by Gerald Gidwitz, chairman of Continental Uranium, Inc. Claims, named Climax No. 1 and No. 2, are held by Atlas Uranium Corp. under lease from Owen Malen, Moab.

Atlas drilling has reportedly proved some 300,000 tons gross ore blocked out. Mining would be by strip, using open pit equipment from Continental's Rattlesnake mine, 15 miles away, says the chairman of the board.

Stepped up production is expected in 1956 from Marcona Mining Co.'s southern Peru deposits, according to Charles E. McGraw, general manager and vice president of the company. Shipments from the port of San Juan in 1955 averaged some 150,000 tons iron ore per month.

Average will be increased to about 225,000 tons per month this year, says McGraw. Total production in 1955 was 1,737,823 tons.

Judge G. A. Layman, of Wyoming's 4th District, has ordered the Pumpkin Buttes Mining District to record claims without the filer agreeing to grant financial consideration to surface owners, in the latest move in the heated Pumpkin Buttes dispute. (See p. 192.)

Since its formation, the District has sought judicial action which would establish it as the only legal recorder of claims. Specific regulation invalidated by the court required a filer to grant 5% overriding royalty and 12½% cash participation in future sales to the surface owner as a condition of recording. Judge Layman said the District's regulation obviously attempts to exert rights over minerals to which the Government has laid exclusive claim.

E & M J Annual Average Metal Prices—1897 to 1955

Year	COPPER (a) Electrolytic Refinery	COPPER Export or Foreign Refinery	LEAD, Common, N. Y.	ZINC, Prime Western (b) E. St. Louis	TIN, (c) N. Y.	SILVER, (e) N. Y.	QUICKSILVER, (f) N. Y.	ALUMINUM Ingot
1897	11.29	.....	3.580	4.120	13.67	59.790	38.50	39.00
1898	12.03	.....	3.780	4.570	15.70	58.260	40.70	30.58
1899	16.67	.....	4.470	5.750	25.12	59.580	43.63	32.72
1900	16.19	.....	4.370	4.390	29.90	61.330	51.00	32.72
1901	16.11	.....	4.330	4.070	16.74	58.950	47.00	33.00
1902	11.026	.....	4.069	4.840	26.79	52.160	48.03	33.00
1903	13.235	.....	4.237	5.191	28.09	53.570	41.32	33.00
1904	12.823	.....	4.309	4.931	27.99	57.221	41.00	35.00
1905	15.590	.....	4.707	5.730	31.358	60.352	38.50	35.00
1906	19.278	.....	5.657	6.048	39.819	66.791	40.90	35.75
1907	20.004	.....	5.325	5.812	38.166	65.237	41.50	45.00
1908	13.208	.....	4.200	4.578	29.465	52.864	44.84	28.70
1909	12.982	.....	4.273	5.352	29.725	51.502	46.30	22.00
1910	12.738	.....	4.446	5.370	34.123	53.486	47.06	22.25
1911	12.376	.....	4.420	5.608	42.281	53.304	46.54	20.07
1912	16.341	.....	4.471	6.799	46.096	60.835	42.46	22.01
1913	15.269	.....	4.370	5.504	44.252	59.791	39.54	23.64
1914	13.602	.....	3.862	5.061	34.301(d)	54.811	48.31	18.63
1915	17.275	.....	4.673	13.054	38.590	49.684	87.01	33.98
1916	27.202	.....	6.858	12.634	43.480	65.661	125.49	60.71
1917	27.180	.....	8.787	8.813	61.802	81.417	106.30	51.59
1918	24.628	.....	7.413	7.890	88.750	96.772	123.47	33.53
1919	18.691	.....	5.759	6.988	63.328	111.122	92.15	32.14
1920	17.456	.....	7.957	7.671	48.273	100.900	81.12	32.72
1921	12.502	.....	4.545	4.655	29.916	62.654	45.46	21.11
1922	13.382	.....	5.734	5.716	32.554	67.528	58.95	18.68
1923	14.421	.....	7.267	6.607	42.664	64.873	66.50	25.41
1924	13.024	.....	8.097	6.344	50.176	66.781	69.76	27.03
1925	14.042	.....	9.020	7.622	57.893	69.065	83.13	27.19
1926	13.795	.....	8.417	7.337	65.285	62.107	91.90	26.99
1927	12.920	.....	6.755	6.242	64.353	56.370	118.16	25.40
1928	14.570	.....	6.305	6.027	50.427	58.176	123.51	24.300
1929	18.107	.....	6.833	6.512	45.155	52.993	122.15	24.300
1930	12.982	.....	5.517	4.556	31.694	38.154	115.01	23.787
1931	8.116	.....	4.243	3.640	24.467	28.700	87.35	23.300
1932	5.555	.....	3.180	2.876	22.017	27.892	57.93	23.300
1933	7.025	6.713	3.869	4.029	39.110	34.727	59.23	23.300
1934	8.428	7.271	3.860	4.158	52.191	47.973	73.87	23.300
1935	8.649	7.538	4.065	4.328	50.420	64.273	71.99	20.000
1936	9.474	9.230	4.710	4.901	46.441	45.087	79.92	20.000
1937	13.167	13.018	6.009	6.519	54.337	44.883	90.18	19.917
1938	10.000	9.695	4.739	4.610	42.301	43.225	75.47	20.000
1939	10.965	10.727	5.053	5.110	50.323	39.082	103.94	20.000
1940	11.296	10.770	5.179	6.335	49.827	34.773	176.86	18.691
1941	11.797	10.901	5.793	7.474	52.018	34.783	185.02	16.500
1942	11.775	11.684	6.481	8.250	52.000	38.333	196.35	15.000
1943	11.775	11.700	6.500	8.250	52.000	44.750	195.21	15.000
1944	11.775	11.700	6.500	8.250	52.000	44.750	118.36	15.000
1945	11.775	11.700	6.500	8.250	52.000	51.928	134.89	15.000
1946	13.820	14.791	8.109	8.726	54.544	80.151	98.24	15.000
1947	20.958	21.624	14.673	10.500	77.949	71.820	83.74	15.000
1948	22.038	22.348	18.043	13.589	99.250	74.361	76.49	15.733
1949	19.202	19.421	15.364	12.144	99.336	71.930	79.46	17.000
1950	21.235	21.549	13.296	13.866	95.539	74.169	81.26	17.713
1951	24.200	26.258	17.500	18.000	127.077	89.368	210.13	19.000
1952	24.200	31.746	16.467	16.215	120.473	84.941	199.097	19.410
1953	28.798	30.845	13.489	10.855	95.845	85.188	193.032	20.931
1954	29.694	29.889	14.054	10.681	91.838	85.250	264.386	21.784
1955	37.491	39.115	15.138	12.229	94.735	89.099	290.348	23.668

(a) Lake copper 1897–98: domestic market since 1932. (b) New York delivery 1898–1902. (c) 99 per cent in 1897 to 1920, inclusive: Straits quality thereafter. (d) Average for eleven months. (e) New York market. . . . All quotations in cents per lb, except for silver, which are in cents per troy oz, and (f) quicksilver, which are in dollars per flask of 76 lb. See opposite page and reverse for weekly average prices for 1955.

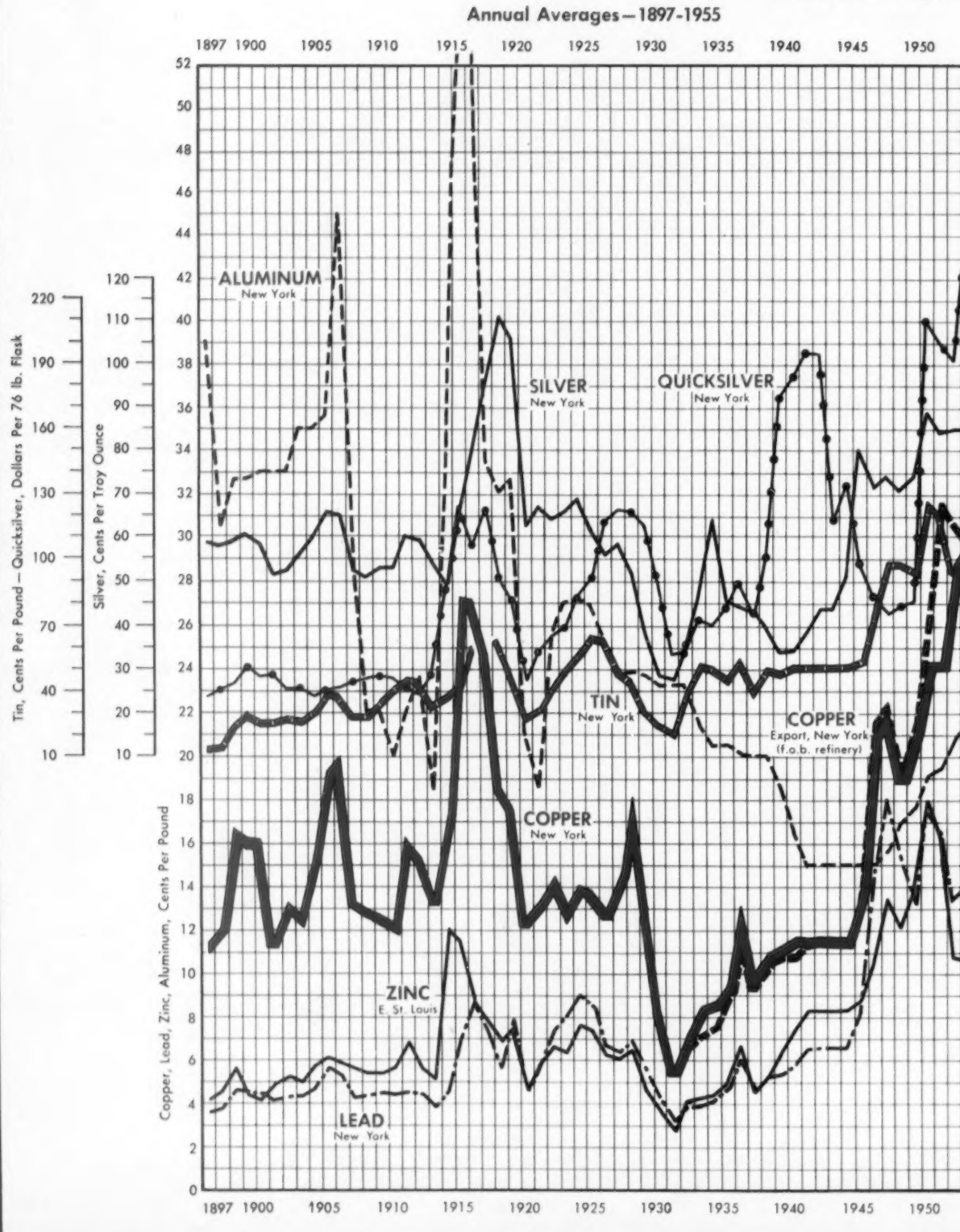
E & M J Weekly Average Metal Prices—1955

	COPPER		LEAD	ZINC	TIN	SILVER	QUICK-	ALUM-
	Domestic, Refinery	Foreign, Refinery	N. Y., Common	E. St. Louis Prime Western	N. Y., "Straits"	N. Y., Foreign	SILVER N. Y.	INUM 99% plus, Ingot
Jan. 5	29.700	31.295	15.000	11.500	87.500	85.250	322.000	22.200
12	29.700	31.567	15.000	11.500	86.229	85.250	322.000	22.367
19	29.700	32.408	15.000	11.500	86.542	85.250	322.000	23.200
26	29.700	33.279	15.000	11.500	87.688	85.250	322.000	23.200
Feb. 2	31.250	34.433	15.000	11.500	89.604	85.250	322.000	23.200
9	32.700	35.804	15.000	11.500	91.250	85.250	322.000	23.200
16	32.700	36.708	15.000	11.500	90.475	85.250	322.000	23.200
23	32.700	36.729	15.000	11.500	90.725	85.250	322.000	23.200
Mar. 2	32.700	36.238	15.000	11.500	91.188	85.250	323.000	23.200
9	32.700	35.788	15.000	11.500	90.875	85.250	323.000	23.200
16	32.700	38.661	15.000	11.500	91.021	87.050	323.000	23.200
23	32.700	37.504	15.000	11.500	91.271	88.750	320.000	23.200
30	33.180	37.454	15.000	11.500	91.250	88.500	320.000	23.200
Apr. 6	35.700	39.158	15.000	11.592	90.917	87.600	317.000	23.200
13	35.700	38.292	15.000	12.000	91.438	87.000	317.000	23.200
20	35.700	37.775	15.000	12.000	91.833	87.000	315.000	23.200
27	35.700	37.483	15.000	12.000	91.521	87.000	315.000	23.200
May 4	35.700	36.325	15.000	12.000	91.188	87.000	313.000	23.200
11	35.700	35.788	15.000	12.000	91.021	87.300	307.000	23.200
18	35.700	36.271	15.000	12.000	91.458	89.582	302.000	23.200
25	35.700	36.058	15.000	12.000	91.625	90.214	300.000	23.200
June 1	35.700	36.504	15.000	12.000	91.625	90.375	295.000	23.200
8	35.700	36.025	15.000	12.000	91.896	90.250	288.000	23.200
15	35.700	36.183	15.000	12.000	93.375	89.450	285.000	23.200
22	35.700	36.754	15.000	12.421	94.417	89.250	281.000	23.200
29	35.700	36.471	15.000	12.500	94.875	89.550	278.000	23.200
July 6	35.700	35.988	15.000	12.500	95.150	90.125	275.000	23.200
13	35.700	35.925	15.000	12.500	95.438	90.125	270.000	23.200
20	35.700	37.025	15.000	12.500	97.313	90.700	262.000	23.200
27	35.700	36.704	15.000	12.500	98.375	90.750	259.000	23.200
Aug. 3	35.700	37.679	15.000	12.500	97.521	90.750	255.000	23.600
10	35.700	38.854	15.000	12.500	96.979	90.750	253.000	24.300
17	35.970	38.521	15.000	12.500	96.417	90.750	253.000	24.400
24	40.575	41.292	15.000	12.500	96.167	90.750	254.000	24.400
31	41.825	42.321	15.000	12.500	95.792	90.750	255.000	24.400
Sept. 7	44.556	43.558	15.000	12.640	95.400	90.750	255.000	24.400
14	44.260	44.863	15.000	13.000	95.792	90.750	260.000	24.400
21	43.665	43.650	15.000	13.000	96.667	90.750	265.000	24.400
28	44.065	45.192	15.250	13.000	96.875	90.750	270.000	24.400
Oct. 5	43.670	43.888	15.500	13.000	96.333	91.650	274.000	24.400
12	43.063	43.146	15.500	13.000	96.025	91.906	275.000	24.400
19	42.945	43.358	15.500	13.000	96.000	91.925	275.000	24.400
26	42.815	43.358	15.500	13.000	96.063	91.625	276.000	24.400
Nov. 2	42.705	43.708	15.500	13.000	96.375	91.625	278.000	24.400
9	42.900	43.404	15.500	13.000	96.300	91.625	279.000	24.400
16	43.144	43.829	15.500	13.000	96.950	91.625	279.000	24.400
23	42.985	43.963	15.500	13.000	98.917	91.625	280.000	24.400
30	42.956	44.392	15.500	13.000	99.275	90.844	280.000	24.400
Dec. 7	43.075	44.404	15.500	13.000	103.229	90.414	280.000	24.400
14	44.185	44.125	15.500	13.000	109.458	90.278	280.000	24.400
21	43.445	45.113	15.500	13.000	109.708	90.600	280.000	24.400
28	43.069	44.120	15.500	13.000	108.800	90.500	280.000	24.400

E&MJ Met

As Published in Engineering & Mining Journal

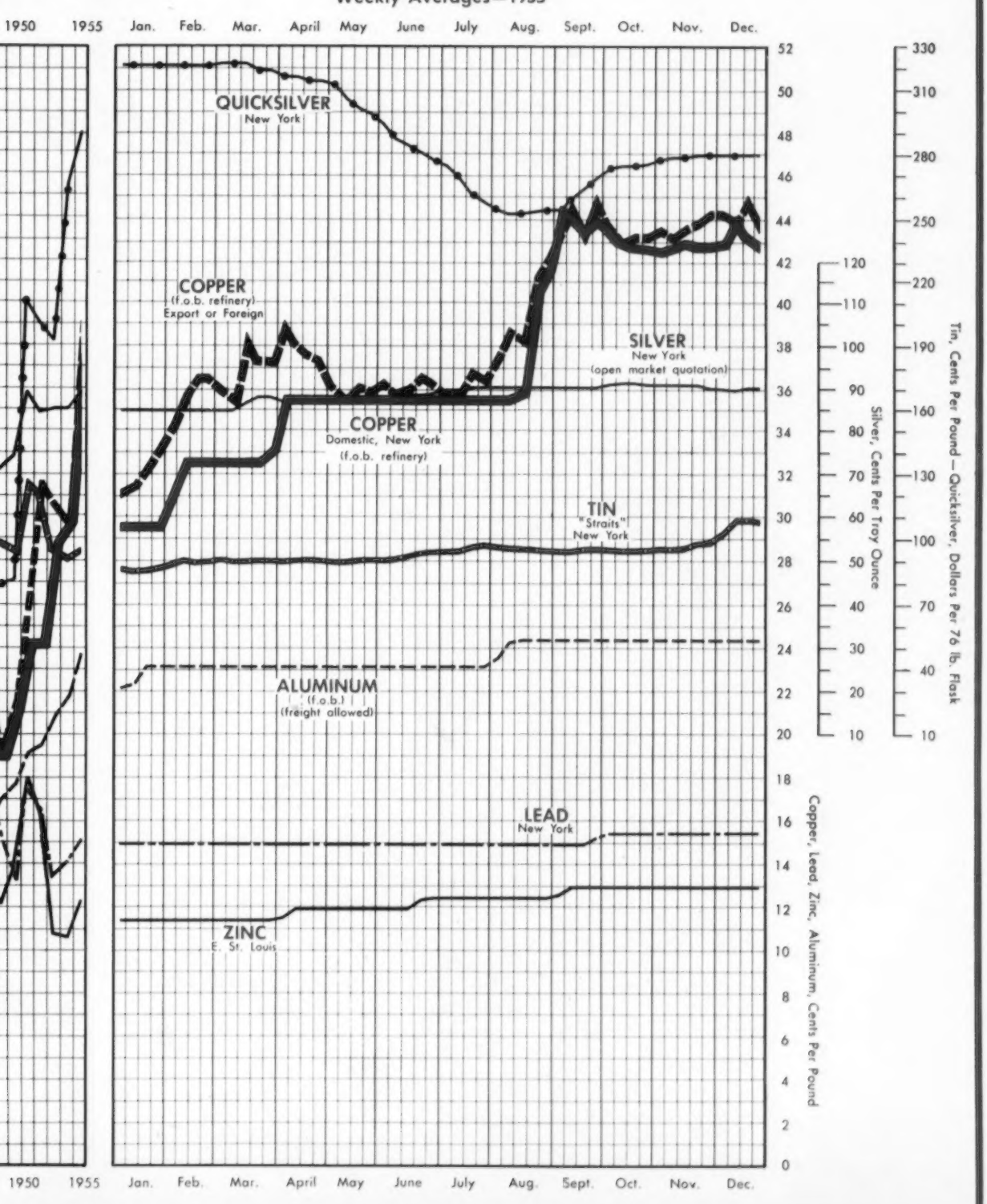
McGraw-Hill Publishing Com



etal Prices

Journal and E&MJ Metal and Mineral Markets

shing Company, Inc., New York



Behind the By-Lines...

G. P. Lutjen

Well, here it is again in glorious technicolor, with a cast of thousands—the annual Survey and Outlook Issue. This is number 87 which puts the whole institution in a fair way of becoming a tradition.

Tradition, of course, isn't necessarily good in itself. You've got to watch it like a hawk and tailor it to the needs of the changing times. Our tailoring this year involved the addition of four more commodities to be surveyed and outlooked—lithium, zirconium, columbium (alias niobium) and tantalum. We think you'll find them good company for our longer standing reviews.

Other changes crept into the issue. Never before have the authors showed so much interest in commodities other than the one they were reviewing. For instance, one of the most fascinating business transactions of 1955, a deal between Aluminum Company of America and TVA shows up, not in the aluminum review, but in Simon Strauss' copper story. And you'll find plenty of cross-indexing in other reviews too.

Speaking of copper, we got curious about the all-time high in the U. S. and finally discovered that the highest monthly average on record was 59½c in July 1864. This of course, is for the U. S. market. If memory serves, the Phoenician market, a few thousand years B. C., give or take a century, topped July 1864 by a drachma or two.

Another tradition under development is the belated Christmas story. This year's tardy tale concerns the little girl who was instructed in Sunday School to draw a picture concerning the birth or early life of Jesus.

The teacher was somewhat puzzled when the little girl submitted a picture of an airplane.

"What incident in Our Lord's life does this depict?"

"That's the flight into Egypt" was the reply, in a tone clearly revealing that the teacher's appalling ignorance had not passed unnoticed.

The teacher recovered nicely. "Oh yes! I see the Mother and Child in the cabin of the plane. But who's flying the plane?"

With a trace of exasperation came the reply. "Why the pilot, Pontius, of course."

Statistics, to judge by 90% of civilization's written record these days, will soon supplant Cleanliness in its runner up spot to Godliness. While not exactly approving the shift, we certainly don't want to be left behind so we are offering the following passel of statistics which we cribbed from *American Machinist,* the magazine of metalworking production.

Why did management men want to change jobs last year? Bernard Haldane of Executive Job Counselors, Inc., NYC, made a survey of 1,000 of them. The average dissatisfied man was 38.46 years old, was married (1.08 wives!) with 2.3 children. His salary is $7,105.36, his 6-room house cost $16,984—but he only owns a third of it. He has had 3.2 years of college, is an engineer in one case out of four, an advertising or publicity man in the same ratio. He drinks a half-case of beer a week, ⅜ quart of stronger spirits (the engineer half as much as the writer). He smokes 15 cigarettes and 1½ cigars a day (as if any smoker could like both!), may like chewing tobacco but has been convinced it's a messy habit. He has 1⅓ dogs, ⅛ cat, 1/20 bird (one man has a coon, another a lion, another a horse, but who could believe 0.001 lion?). Personally, we'd be terrified of a job seeker with these bewildering attributes, but Mr. Haldane assures us he'll find a job, idiosyncrasies, parts of animals and all.

PLAN AHEAD

Las Vegas alumni and Safety Men alike should find something of interest in this story of a game of chance.

A man placed 331 pills in a bottle. Three hundred of these pills contained common bicarbonate of soda, 30 were composed of a harmless hangover cure but one contained potassium cyanide. All the pills were mixed together and when they were emptied on the table all looked alike.

"How many here are willing to take a chance and swallow one of these pills?" he asked his audience. But not a man in the audience moved to accept the challenge.

Finally as he waited patiently he said, "I guess right now that you men put very little value on your time but it might be interesting for you to know that in one out of 331 instances when a man attempts to beat a traffic light a fatality occurs."

Uranium fever can't be counted out. There is now a Greater New York State Uranium Prospectors and Developers Association, a thriving organization with over 100 members. We found out about GNYSUPDA when Richard A. Brown, executive secretary of the group turned up as our seat mate on a recent flight to Chicago. Headquarters for the organization, he told me, are at 19 E. 48th Street, New York, N. Y., and new members are welcome. The group has already held its organizational meetings and plans to run classes in prospecting this year. An eight point program reveals a remarkable grasp of the mining industry by these easterners. Among other things, they exhibit the underlying optimism of miners everywhere by declaring as one of the purposes, the establishment of a centrally located mill or ore-buying station in New York. Another avowed purpose of the GNYSUPDA is "to get maximum aid and minimum interference from the Government."

Oh, they're catching on quick! We wish them luck.

Major Metals

M. A. Kriz **Au**
Chief, Foreign Research Div.
Federal Reserve Bank of New York

Francis H. Wemple **Ag**
Treasurer
Handy and Harman

Simon D. Strauss **Cu**
Vice President, Sales Mgr.
American Smelting and Refining Co.

Robert L. Ziegfeld **Pb**
Secretary
Lead Industries Association

Charles R. Ince **Zn**
Vice President, Sales Manager
St. Joseph Lead Co.

Irving Lipkowitz **Al**
Assistant to the President
Reynolds Metals Co.

J. D. Hanawalt **Mg**
Vice President, Manager
Magnesium Div.
Dow Chemical Co.

Jack Kratchman **U**
Mining Engineer
U. S. Atomic Energy Comm.

George H. Cleaver **Sn**
Market Editor
Engineering and Mining Journal

IF YOU DIDN'T THINK it was a rousing year for non-ferrous metals, take a look at the *E&MJ* Index of Non-Ferrous Metal Prices on the cover. Not since the 39-point jump in '47 has there been such a spectacular leap as 1955's 31 points.

Under the spur of the highest rate of industrial activity that the United States has ever known, most of the major non-ferrous metals sprinted to record, or near-record years in consumption and production, several major strikes notwithstanding.

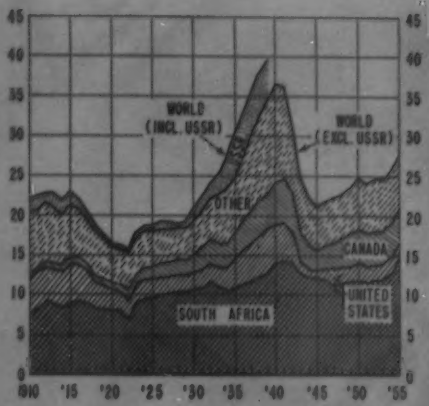
Outlook for 1956 varies from a cautious optimism in the lead and zinc industries to the let-me-at-'em enthusiasm of the aluminum people. Magnesium and titanium look forward to further experience, sometimes painful, but always exhilarating when growing up. And uranium, too, is showing maturity to the point where its spokesmen refer to "continued high level of activity" instead of "rushes" and "booms."

But what is perhaps one of the most significant trends remains undisclosed by statistics—the growing awareness in metal men of the competition from other metals and materials.

Thomas W. Lippert **Ti**
Mgr., Sales & Tech. Svce.
Titanium Metals Corporation of America

World Gold Production

(In millions of fine ounces)



Note: All 1955 data are provisional.
* Including Philippines through 1939.

	1940	1945	1952	1953	1954	1955*
North America:						
Canada	5.3	2.7	4.5	4.1	4.4	4.5
United States	4.9	0.9	1.9	2.0	1.9	1.9
Latin America:						
Mexico	0.9	0.5	0.5	0.5	0.4	0.5
Colombia	0.6	0.5	0.4	0.4	0.4	0.4
Chile	0.3	0.2	0.2	0.1	0.1	0.1
Nicaragua	0.2	0.2	0.3	0.3	0.2	0.2
Africa:						
Union of South Africa	14.0	12.2	11.8	11.9	13.2	14.6
Gold Coast	0.9	0.5	0.7	0.7	0.8	0.8
Southern Rhodesia	0.8	0.6	0.5	0.5	0.5	0.5
Belgian Congo	0.6	0.3	0.4	0.4	0.4	0.4
Asia:						
India	0.3	0.2	0.2	0.2	0.2	0.2
Philippines	1.1	...	0.4	0.5	0.4	0.4
Australia	1.6	0.7	1.0	1.1	1.1	1.1
Total	31.6	19.5	22.8	22.7	24.0	25.6
Other countries, excluding USSR	5.1	1.6	2.0	2.0	2.1	2.1
World, excluding USSR	36.7	21.1	24.8	24.7	26.1	27.7

* Tentative figures based on preliminary data.
Note: Figures may not add up to totals because of rounding.

GOLD

Dr. M. A. Kriz*
New York, N. Y.

THE YEAR 1955 was marked by a further increase in world gold output, larger additions of newly-mined gold to official monetary gold reserves, and a continued build-up of monetary reserves, including dollar assets, of foreign countries as a whole. It was also characterized, however, by renewed inflationary strains in a number of countries, which adversely affected gold mining costs as well as monetary conditions in general, and in some cases brought about balance-of-payments stresses and sizable gold and dollar losses. However, most of this deterioration in monetary reserves was accounted for by developments in certain sterling area countries and in a few countries of Latin America. Despite these difficulties, the pattern of world trade and payments remained freer and more nearly sustainable than only 2 or 3 years ago.

Rise in world gold output. World production of gold (excluding the USSR) amounted last year to some 27.7-million fine oz, or 1.6-million more than in 1954 (see table), on the basis of preliminary or incomplete data available at the year-end. Last year was, therefore, the second consecutive year of marked expansion in world gold output, following a period of relative stability at 24.7 million oz from 1950 through 1953.

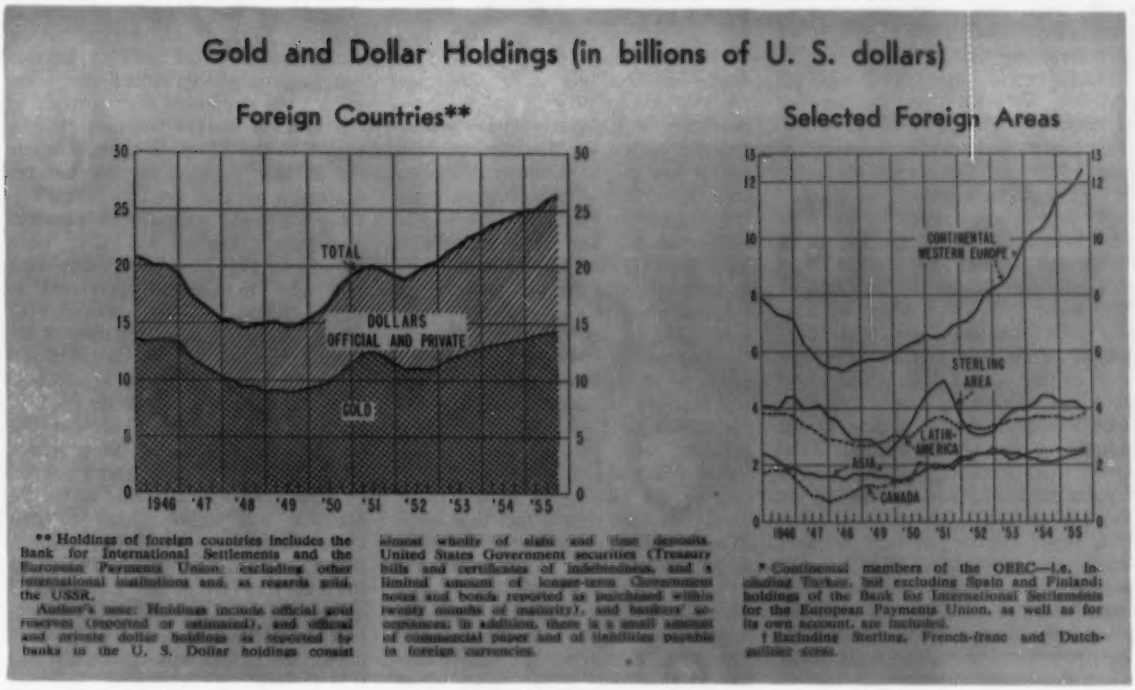
Earlier apprehensions in certain quarters that, under postwar conditions, world gold output would fail to recover were thus further dispelled in 1955. Last year's output was, it is true, some 10-million oz below the 1940 all-time record, as may be seen from the chart, but it was more than 6.5-million oz above the 1945 postwar low, and 3.7-million oz above the 1951 trough.

During the postwar years from 1945 through 1953 world gold output rose at an average annual rate of about 2%; the 6% rise in 1955, on top of a similar rise during the previous year, therefore marked a notable acceleration in production. At the official United States price of $35 per oz, value of last year's output was about $970-million, compared with $915-million in 1954 and $740-million in 1945.

The 1.6-million-oz rise in last year's output was accounted for, to the extent of 1.4-million, by expansion in South African production. At some 14.6-million oz, South African output was last year 1.4-million oz or 11% above 1954, which in turn was 11% above 1953 when the recent rise in output began. Last year South Africa's output thus slightly exceeded its record of 1941.

The rise in South African production, as in 1954, was attributable principally to the continuing increase in the output of the new mines of the Orange Free State and of the Far West Rand extensions of the Transvaal. Output of these new mines increased from less than 0.5-million oz in 1953 to 1.1-million in 1954 and probably some 2.4-million in 1955; toward the year-end it was equal to about one fifth of the production of the Transvaal, which comprises mainly the older mines. Output of the new mines is expected to expand significantly over the coming years.

*Author is chief, Foreign Research Div., Research Dept., Federal Reserve Bank of New York. Views expressed are his own and not meant to reflect those of the bank.



** Holdings of foreign countries includes the Bank for International Settlements and the European Payments Union; excluding other international institutions and, as regards gold, the USSR.

Author's note: Holdings include official gold reserves (reported or estimated), and official and private dollar holdings as reported by banks in the U. S. Dollar holdings consist almost wholly of sight and time deposits, United States Government securities (Treasury bills and certificates of indebtedness, and a limited amount of longer-term Government notes and bonds reported as purchased within twenty months of maturity), and bankers' acceptances; in addition, there is a small amount of commercial paper and of liabilities payable in foreign currencies.

* Continental members of the OEEC—i.e. including Turkey, but excluding Spain and Finland; holdings of the Bank for International Settlements for the European Payments Union, as well as for its own account, are included.

† Excluding Sterling, French-franc and Dutch-guilder areas.

In Canada, where production had fallen in 1953 and early 1954 because of labor difficulties in certain mining areas, output increased last year to 4.5-million oz, or to the 1952 level when the postwar peak was reached. In the U. S., gold production stood at about 1.9-million oz (on the basis of the first ten months), or about the same as in earlier years. In Australia, India, and the Philippines, on the Gold Coast and in Southern Rhodesia, and in Latin America, production, on the whole, remained stationary. No data are of course available for the USSR, probably the second largest world gold producer.

Gold mining costs continued to rise last year in most gold-producing countries. In South Africa, the average working costs per ton milled rose from January to September by 4%, as against 6% during the entire year 1954; this compares with an 8% rise in 1953, 5% in 1952, and 10% in 1951.[1] Continued rise in costs during the past year was a matter of concern. However, the supply of South African native labor, which was an important production bottleneck until about two years ago, was further relieved in 1955; similarly, the shortage of electric power became less acute. Total working profits rose again last year, perhaps as much as 17%, after a 9% rise in 1954; they had declined noticeably from 1950 to 1952. In addition, certain South African mines derived increased profits from the extraction of uranium.

In Canada, higher-cost producers last year continued to receive a government subsidy provided they channeled their entire output into the official reserves; as a matter of fact, all mines did so in 1955. Emergency assistance to gold mines, which was put into effect in 1948 and renewed several times, was extended last year to 1955 and 1956; however, under the new arrangements the subsidy available to lower-cost mines was reduced, while that available to higher-cost mines was increased, and the total amount payable was less than was paid under the previous formula. As a result of the disappearance of the Canadian dollar's premium in terms of the U. S. dollar, which will be noted later, the Canadian gold price rose from Can. $33.85 per fine oz at the beginning of the year to the equivalent of the U. S. price at the year-end.

A subsidy scheme also exists in several other countries, including Australia, Colombia, and the Philippines. As in Canada, such subsidization has been designed to benefit marginal producers, the amount of subsidy being related to the presumed economic need of various categories of mines and subject to various conditions.

Newly-mined gold flowed into official monetary gold reserves in larger amounts last year. Correspondingly smaller amounts were absorbed by private demand.

The flow of gold from production into monetary and other uses can best be seen by tracing it separately in the U. S. and in the rest of the world. In the United States, gold output last year was worth somewhat less than $70-million. On the other hand, gold consumption in industry, the professions, and the arts was of the order of $100-million, on the basis of the experience of recent years; of this amount some $30-million or so was supplied by the return of scrap gold. Net consumption in the U. S. was thus more or less equal to the current output.

In countries other than the U. S. (and the USSR), official monetary gold reserves (including those of the international financial institutions) increased during the twelve months ended September 1955 by some $800-million.

Of this amount $142-million was purchased from the U. S.; the remainder was derived principally from ac-

[1] Measured per ounce of gold produced, however, the rise in working costs was somewhat less than per ton milled: 10% in 1951, 3% in 1952, 4% in 1953, and only 1% in 1954; there was a small decline in 1955, but the relatively favorable results in 1954 and 1955 were attributable largely to the increase in the gold yield in the newly opened Orange Free State mines.

cruals from new production, but to some extent also from purchases of gold from the USSR.

During 1955, the USSR was reported to have sold, for the purpose of acquiring certain Western European currencies, varying amounts of gold either in Continental Western Europe or on the London gold market. According to a statement by the British Chancellor of the Exchequer in Parliament last July, the United Kingdom imported during the first half of 1955 some $50-million worth of Russian gold; this compared with $45-million in the first half of 1954 and none in the second half. Continental European countries, too, imported some Russian gold; according to the Bulletin of the United Nations Economic Commission for Europe, such imports totaled $50-million during the first half of 1955. There were, however, fewer reports of such imports during the remainder of the year. Some of the gold may have been held under earmark for Russian account, either in London or on the Continent; imports are not therefore tantamount to net purchases. Assuming, however, that the USSR exported gold, not to keep it under earmark abroad, but rather to reconstitute its Western European currency balances which had been depleted by purchases of capital and consumer goods from the sterling area and other non-dollar countries, Russian gold sales may well have been of the order of $100-million during the twelve months ended September 1955. At least a portion of this gold probably appeared in the official reserves of the countries concerned.

Of the $800-million increase in official monetary reserves of countries other than the United States (and the USSR), as much perhaps, as $600-million may accordingly be regarded as having accrued principally from new production—assuming that on balance there was no dishoarding of privately-held gold in the world at large. Gold output in countries outside the U. S. and the USSR amounted to some $900-million during the year ended September 1955. It would thus appear that the equivalent of perhaps as much as two-thirds of the current gold output in these countries found its way into official monetary reserves, as against only one-third from mid-1950 through the fall of 1953, and some three-fifths in 1954.

The difference of some $300-million between the gold output and the accretions to official monetary reserves can be accounted for principally by private utilization of gold. Distinction between the various uses—from genuine consumption in the arts and industry to hoarding as a traditional form of savings or as a hedge against monetary depreciation—has become blurred during the last fifteen years and is now largely a matter of conjecture. Nevertheless, the residual quantity of gold that could not otherwise be accounted for last year appears to have been smaller than even in 1954; in addition, with the weakening in the propensity of private demand to absorb gold, a larger portion of the residual could be regarded as having been, in effect, consumed in the arts and industry. Before the war, approximately identical amounts of gold, it is believed, were used in the arts and industry in the rest of the world (excluding the USSR) as in the U. S. Today, in view of the fact that levels of employment and incomes are higher than before the war, both in real terms and, in many countries, even after allowing for the increase in population, genuine gold consumption outside the U. S. may well be higher than the $100-million dollar figure given above for the U. S.

Among the signs of the strength of the hoarding demand in France—a country where private demand for gold is known to have been particularly large during the earlier postwar years—is the premium of gold coins over bars. This premium, which was some 20% in early 1954, fell to about 7% at the beginning of 1955 and to as low as 2% in early June; subsequently it rose again, and at the year-end stood at about 10%. Comments in the French press on the transactions on the Paris gold market, where domestically-held gold can be traded freely, indicate that the authorities at various times during the year acquired gold offered by private holders. Far Eastern countries continued throughout most of 1955 to absorb gold at about normal rates, according to market comments; but the Middle Eastern demand reportedly increased somewhat.

A notable development last year was the increased importance of the London gold market, which was reopened in 1954 after a closure of almost 15 years. South Africa, which produces some 80% of the sterling area's gold output, sold in 1955 the great bulk of its gold in London. South African gold producers sell gold to the South African Reserve Bank, which pays for it at rates based on the London market price. Under informal arrangements that became effective in January 1955, South Africa has no commitment to sell gold in London but, according to an official announcement, "the maximum use" is made of the London market because, "having regard to the international nature and the leading position of the London market, it appears unlikely that a better price could normally be obtained elsewhere." During the first eight months of 1955, the total South African sales in London amounted to £106-million ($297 million), of which, however, approximately £48-million was paid to the United Kingdom for hard-currencies purchased from the sterling area's dollar pool. In addition, London also received the sizable output of British West Africa and Southern Rhodesia, and a portion of Australia's output (some of the remainder was either added to that country's monetary reserves, while a certain amount was reportedly sold in the free markets in the East). Gold originating from various non-Sterling-area countries, including, as already noted, the USSR, was reportedly also sold in London. Canada, on the other hand, sold little of its gold in London.

Principal buyers in London were the central banks in Western Europe; some gold was also sold to private operators, especially in the East and Far East. While there are no restrictions on sales of gold in London, purchases by British and other Sterling area residents are subject to licensing, which is granted only for limited quantities of gold for trading and industrial purposes; residents of all other countries may buy gold only if payment is made in American-account or Canadian-account Sterling, which has always been fully convertible into dollars, or in the so-called "Registered Sterling," issued only against dollars or against gold itself, that was established for this purpose at the time of the reopening of the London gold market in March 1954.

As trading developed in London, the London gold price became increasingly important. This price[1] varied during 1955 between the high of 251 s. 11 d. per fine oz in February and 249 s. 5 d. in December; it generally moved with the sterling-dollar exchange rate, and when converted at the current dollar rate it fluctuated between $35.07 and $34.97. A factor that, along with the growing volume of transactions, contributed to maintaining the London gold price within rather narrow limits was the Bank of England's readiness

[1] All prices quoted in this article are approximate weekly averages.

to intervene in the market as a buyer or seller, either on behalf of the Exchange Equalization Account or as agent for the South African Reserve Bank.

During the entire year, the dollar equivalent of the London price was therefore below $35.0875, i.e., $35 plus the ¼% handling charge, at which the Federal Reserve Bank of New York, acting on behalf of the United States Treasury, sells gold to other central banks. As a result, central banks found it advantageous to purchase gold in London rather than in New York whenever they did not wish to add to their gold reserves under earmark in New York. After the dollar equivalent of the London price had fallen in mid-September 1955 below $35 per oz, the volume of transactions on the London market was reported to have increased markedly. One of the reasons for this was that Continental European central banks could purchase gold a few cents below $35 to settle their indebtedness vis-a-vis the European Payments Union, which can be done at the debtor's option either in dollars or in gold valued at $35.

The price at which gold is traded directly for U. S. dollars in foreign markets other than London remained within a few cents of the London gold price. In markets where gold is traded in national currencies, the prices did not follow closely the day-to-day fluctuations in the London price, but the over-all price movements remained last year within narrower limits than even in 1954. In Paris, the price of bullion per fine ounce, converted into U. S. dollars at the "parallel" market exchange rate, rose from the equivalent of $35.60 in January to $36.35 in mid-May, but fell off subsequently, and during most of the second half of the year stood at $35.90. In Brussels, on the other hand, gold price fluctuations were small; at the year-end, restrictions on the sale, import, and export of gold were lifted in Belgium-Luxembourg. In Hong Kong, the U. S. dollar equivalent of the gold price fluctuated between $37.90, in August, and $38.20, in December. In India, where restrictions on gold exports and imports remain stringent, the price of gold in the Bombay gold market continued to be determined principally by local supply and demand conditions; converted into dollars at the official exchange rate, it ranged from a low of $49 at the beginning of the year to a high of about $55 at the year-end.

Continued rise in foreign gold and dollar holdings. As a result principally of larger accretions of newly-mined gold to official monetary stocks, monetary gold reserves of foreign countries (together with those of the Bank for International Settlements and the European Payments Union, but excluding the gold holdings of the USSR) increased during the year ended September 1955 by some $800-million to $14.4-billion (Chart p. 77). United States monetary gold stock declined during this period by $118-million to $21,745-million, it stood at $21,752-million at the year-end. The International Monetary Fund held $1,751-million worth of gold in September 1955. Altogether, world monetary gold reserves (excluding those of the USSR) amounted to $37.9-billion dollars in September 1955, as against $37.2-billion a year earlier. In September 1955, the U. S. thus held 57% of the world monetary gold stock, as against 70% in September 1949 and about 60% in 1945.

Besides gold, foreign countries held in September 1955 about $11.9-billion in the form of dollars on both official and private account (primarily deposits in U. S. banks and short-term and certain longer-term United States Government securities), or about $1-billion more than a year previous. Total gold and dollar holdings of foreign countries in September 1955 amounted to $26.3-billion, or $1.8-billion above September 1954, and $5.5-billion higher than in December 1945 before the serious depletion of the earlier postwar years. They were also $11.5-billion or nearly 80% higher than in September 1949, the date of the general currency devaluations, and $7.3-billion or some 40% higher than in March 1952, the post-Korea low.

These aggregates, however, conceal important changes in gold and dollar holdings of particular countries and areas (Chart p. 77). The holdings of Continental Western Europe increased by $1.7-billion during the twelve months ended September 1955, more than half of the rise going into the Bank of France reserves (over $500-million) and into West Germany's reserves (over $400-million); Italian and Belgian holdings likewise increased considerably (by $241-million and $122-million, respectively). Aggregate holdings of Latin American countries rose by $92-million; Mexico's and Brazil's holdings increased but those of a number of countries, including Argentina and Colombia, declined. Gold and U. S. dollar holdings of Canada rose by $80-million from October 1954 through September 1955, but according to preliminary data they declined during the last quarter; as officially stated, Canadian reserves were employed to contribute to orderly conditions in the exchange market, and not to reverse persistent trends, and in fact the premium of the Canadian dollar over the U. S. dollar, which stood around 3% during most of 1954, fell below 2% in early 1955 and virtually disappeared toward the year-end. Gold and dollar holdings of non-sterling Asian countries increased by some $350-million, largely because Japan and Indonesia added some $200-million and $50-million to their holdings; those of the Philippines declined by $50-million.

Aggregate gold and official and private holdings of Sterling area countries declined by about $500-million during the twelve months ended September 1955. Central gold and official dollar holdings held by the United Kingdom as the area's banker declined during this period by $556-million to $2,345-million, as against $2,901-million in September 1954; they fell to $2,120-million in December 1955, partly because of the payment in December of $188-million under postwar debt and lend-lease settlement agreements with the United States and Canada.

The $1.8-billion gain in aggregate gold and dollar holdings of foreign countries, as already noted, originated to the extent of over $600-million in the absorption of newly-mined gold into official reserves and purchases from Russia. The remainder, $1.2-billion, was the outcome of transactions of foreign countries with the U. S. Payments made by the U. S. for imported goods and services, which are the largest source of foreign dollar earnings, reached $16.9-billion during the year ended September 1955, as against $15.9-billion a year previous; these figures include offshore purchases and other U. S. military expenditures, which amounted to nearly 25% of U. S. merchandise imports in both periods. Dollars supplied to foreign countries under U. S. Government economic grants and credits (excluding military aid) increased by $335-million to $2.0-billion; U. S. aid was still an important element in total dollar receipts of a number of foreign countries. The net outflow of private U. S. capital, which is another source of dollars for foreign countries, was

(Continued on p. 243)

World Silver Production

(Millions of ounces)

	1951	1952	1953	1954	1955
Mexico	43.8	50.4	47.9	39.9	45.0
United States	39.9	39.8	37.7	38.1	35.0
Canada	23.1	25.2	28.3	30.7	27.7
Peru	15.0	18.4	19.3	19.9	20.0
Bolivia	7.1	7.1	6.1	5.0	4.5
Other South and Central American countries	6.6	7.2	8.8	7.4	6.5
Total Western Hemisphere	135.5	148.1	148.1	141.0	138.7
Outside the Western Hemisphere	63.6	68.7	68.3	67.7	65.0
World production	199.1	216.8	216.4	208.7	203.7

Treasury Silver

(Millions of ounces)

	Dec. 31 1951	Dec. 31 1952	Dec. 31 1953	Dec. 31 1954	Dec. 31 1955
Held in the Treasury:					
Securing Silver Certificates:					
Silver bullion	1,603.7	1,631.7	1,655.7	1,679.2	1,697.2
Silver dollars	232.8	223.8	215.2	207.0	196.1
Subsidiary coin	1.2	2.8	4.6	34.5	11.3
Free silver bullion	124.5	81.7	49.6	13.6	24.9
Total Treasury stocks	1,962.2	1,940.0	1,925.1	1,934.3	1,929.5
Outside the Treasury:					
Silver dollars	148.0	156.6	164.9	172.5	182.0
Subsidiary coin	783.5	837.7	877.5	898.9	928.3
Total silver outside the Treasury	931.5	994.3	1,042.4	1,071.4	1,110.3
Total silver	2,893.7	2,934.3	2,967.5	3,005.7	3,039.8

SILVER

Francis H. Wemple
Handy & Harman

RIGID PRICE STABILITY, which after more than two years had come to be characteristic of silver, ended early in 1955. Demand for silver throughout the world increased substantially over 1954, and as a result, the average price level was higher. Nevertheless, price increases were relatively moderate, and fluctuations took place within a fairly narrow range.

In the United States consumption of silver in the arts and industries amounted to 100-million oz during 1955. This was an increase of about 18% over 1954 and compares with an average of 99-million oz for the past five years. The improvement over 1954 was felt in all lines, and was particularly marked in electrical and electronic uses. Demand remained relatively steady throughout the year with less than the usual seasonal variations, and the increased consumption of silver, both in this country and abroad, led to added activity in the market compared with previous years.

Altogether there were 25 changes in the New York published price during 1955. The withdrawal of the Bank of Mexico from the market early in the year ended the long period of stable prices. At the opening of the year there was no indication of any early price change. The published quotation in New York was 85¼c, and this rate had been in effect since Jan. 16, 1953. Supply and demand were in balance and the Bank of Mexico maintained this balance by buying or selling to offset other variations. In February, demand for industrial use and coinage began to show improvement, and of particular significance at this time were reports that Saudi Arabia was negotiating a coinage order with Mexico. This order was actually completed by the end of February and amounted to 17.2-million oz. Furthermore, West Germany, to which Mexico had made substantial sales in 1954, made new commitments to buy at the rate of about 1.5-million oz a month. In addition, the Bank of Mexico received increasing orders from New York to augment more regular sources of supply. The Bank announced on March 11 that it had no more silver to sell, and a sharp price rise was the result. On March 15 the published rate advanced 4½c to 89¾c, the first price change in the New York market in 26 months.

A period of price uncertainty followed. Initially the price rose to 89¾c and then reacted to 87c by April 4. It recovered again in May and by the 18th of that month reached 90.16c, at which level it is probable that some domestic production was sold in the market rather than to the Treasury.

Silver Quotations

	New York price (In cents)			London spot (In pence)		
	High	Low	Average	High	Low	Average
1955	92.000	85.250	89.099	80.250	73.750	77.507
1954	85.250	85.250	85.250	74.375	72.000	73.482
1953	85.250	83.250	85.188	74.000	72.875	73.945
1952	88.000	82.750	84.941	77.000	72.500	74.360
1951	90.160	80.000	89.368	78.500	70.000	77.856
1950	80.000	71.750	74.169	70.000	63.000	64.796
1949	73.250	70.000	71.930	64.000	42.500	49.243
1948	77.500	70.000	74.361	47.000	42.500	45.004
1947	86.250	59.750	71.820	55.500	37.000	44.440
1946	90.125	70.750	80.151	55.500	44.000	48.700

World Silver Consumption

(Millions of ounces)

Arts and Industries	1951	1952	1953	1954	1955
United States	110.0	95.0	105.0	85.0	100.0
West Germany	10.0	10.3	11.9	24.2	31.5
Great Britain	16.6	9.1	11.9	12.2	14.0
France	10.4	10.5	14.5	10.5	11.0
Japan	3.5	3.5	5.6	5.8	6.2
Canada	4.4	3.8	4.7	3.9	4.4
Other countries	10.1	9.8	10.0	10.5	12.0
Total	165.0	142.0	163.6	152.1	179.1

Coinage	1951	1952	1953	1954	1955
United States	44.4	57.3	42.7	53.1	8.2
Saudi Arabia	20.6	23.0	—	—	17.2
West Germany	.3	14.1	3.3	—	.1
Mexico	4.8	7.1	18.6	—	2.3
Canada	3.1	3.0	3.8	1.8	.5
Other countries	17.3	9.8	16.3	11.5	10.0
Total coinage	90.5	114.3	84.7	66.4	38.3
Total consumption	255.5	256.3	248.3	218.5	217.4

As additional quantities of domestic production were needed, buyers had to pay a higher price in order to compensate for extra transportation charges from distant delivery points. A seasonal drop in demand in June resulted in a somewhat lower price, but the decline was temporary because strikes created an unexpected reduction in supplies. In a short time regular sellers were unable to supply the market with more than token amounts of silver, and the domestic trade turned to the Government for their requirements. Under the authority of the Act of July 31, 1946, the Treasury made silver available to qualified users on application at 91c per fine troy oz at the New York Assay Office, and accordingly on July 15 the published price in New York reached 90¾c. The published price is the price for silver in unrefined materials and is ¼c below the rate at which refined bullion is sold.

For the next four months the Treasury Department was the dominant factor in the market. During August and September increasingly large purchases were made at the New York Assay Office and this led to a change of Treasury policy relating to the sale of silver. With the New York Assay Office selling price at 91c, domestic silver refined on the West Coast was still being delivered to the San Francisco Mint at the statutory buying rate of 90½c because the ½c differential was insufficient to attract West Coast Silver to New York. This put the Government in the position of buying silver at San Francisco at the same time that it was selling it in New York, and in effect, absorbing transportation costs. On Sept. 29 the Treasury announced that effective immediately an additional 1¼c per ounce would be charged for sales at the New York Assay Office, this addition representing the cost of shipping silver by Railway Express from the West Coast. Meanwhile, silver would still be available at 91c, but only at the San Francisco Mint.

U. S. Foreign Trade in Silver

(Millions of ounces)

U. S. Imports	1954	1955 estimated
Canada	21.5	20.2
Mexico	30.0	21.7
Peru	14.5	10.3
Bolivia	4.4	3.1
Cuba	.2	.3
Other Western Hemisphere countries	5.0	4.0
Total Western Hemisphere	75.6	59.6
The Netherlands	11.3	18.2
United Kingdom	.2	—
Other European countries	.2	—
Japan	1.0	.1
All other countries	3.0	5.9
Total imports	91.3	83.8

U. S. Imports	1954	1955 estimated
Mexico	—	1.5
United Kingdom	1.0	.7
West Germany	.4	1.5
All other countries	1.8	.7
Total exports	3.2	4.4

This new Treasury policy created an unusual price situation in New York. A recent change in regulations, which had been effective for only some three months, for the first time permitted common carrier trucks to transport silver. The scheduled rates on lots in excess of 10 tons made it possible to bring silver East at a cost well below the 1¼c rate charged by Railway Express. Buyers immediately made arrangements to take advantage of this, but the market did not at once reflect the saving, because the need for quick delivery made it necessary to continue buying from the New York Assay Office until silver could be obtained from San Francisco. Producers' supplies temporarily became available at 92⅛c, or ⅛c below the effective New York Assay Office price of 92¼c (91c plus 1¼c transportation), and the quotation on Sept. 30 accordingly was published at 91⅞c. However, on Oct. 11 it again became necessary to buy from the New York Assay Office and on that day the published price went up to 92c. This proved to be the high for 1955, and indeed the highest recorded price in New York for 35 years.

The first shipment by truck from the San Francisco Mint arrived in the East Oct. 19 and that day the price dropped to 91⅜c reflecting the transportation saving. Continuing shipments of Treasury silver from San Francisco, together with gradually improving supplies from regular sources, served to stabilize this price for the next several weeks.

During the latter part of November, there was a marked decline in trade demand. With producer supplies increasing, the price became weaker and dropped rather sharply reaching 90c by Nov. 29. This ended that phase of the market's history which was dominated by the U. S. Treasury's selling price, and again brought about a period of moderate fluctuations. Prices became quite sensitive to daily changes in the relationship between the market's needs and the producers' supplies. For the most part, foreign silver alone was inadequate and the

(Continued on p. 244)

COPPER

Simon D. Strauss
American Smelting & Refining Co.

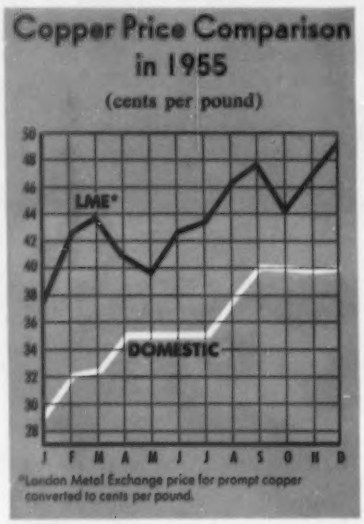
OF THE COPPER MARKET IN 1955, it could aptly be said "Never have so many been so wrong."

As 1954 ended, the consensus in the copper industry, among producers and consumers alike, was that copper prices might be subject to downward pressure in 1955. True, during 1954 demand had exceeded supply—but this was due to production being at less than full capacity early in the year and later, subject to protracted strikes.

Looking forward to 1955, most industry observers at the end of 1954 envisioned a substantial increase in output as new mines came into production. They speculated as to how readily all this metal could be absorbed at the then current market price. This price in New York, as quoted by the larger producers, was 30c per lb; in London it was £290 a long ton, about 36c per lb. Only on one day during 1954 had the price of copper been above £300 a long ton in London—and that once was in October, when U. S. strikes were at their height.

Price. But what seemed to be high prices at the beginning of last year had an entirely different look at the end of the year. By the middle of January 1955, the London price for prompt metal rose above £300 a long ton and did not again fall below that level during the year. It ended the year at £400. The course of the ascent was by no means uniform as indicated by the accompanying chart. Violent fluctuations occurred not only from month to month, but also within the individual month—thus in April the high bid was £360 a long ton; the low bid was £303; the average was £328.

Major U.S. producers, conscious of their competitive position with respect to such other materials as aluminum, plastics, and steel (all of which are sold on the basis of fairly stable prices), did their best to avoid these sharp fluctuations. Regardless of their own judgment of the situation, however, they were reluctantly compelled to revise their prices periodically—and each revision was upward—from 30c to 33c to 36c to 40c and finally to 43c. Sellers other than the major producers quoted a variety of prices to domestic consumers—the highest in the course of the year being 53c a pound. Substantial quantities were sold by custom smelters at 50c.


Copper Price Comparison in 1955
(cents per pound)
LME*
DOMESTIC
J F M A M J J A S O N D
*London Metal Exchange price for prompt copper converted to cents per pound.

These are the highest prices quoted for copper in the U.S. in modern times. Previous peaks in the industry's history have been witnessed in times of war—World War I and the Korean War being the outstanding examples (price controls were effective in World War II). But 1955 was a year of relative peace in most of the Western World; in fact, the ratio of military expenditure to over-all income was on the decline. What then caused the upsurge of inflation in the market?

Demand played an important part. New records for consumption were set in the area outside the Iron Curtain (see table covering statistics of 1953, 1954, and 1955). Improvement occurred both in the U.S. and outside it. In this country the use of copper reattained the high level of 1953; in the rest of the world the use of copper was about 50% above 1953.

Production. But good demand was not the principal explanation for the price crisis. Other industries also experienced gains in volume of sales without skyrocketing prices. The explanation in copper lay in an unexpected series of major interruptions in operations by producers. The year started with a serious and prolonged strike in Northern Rhodesia, the principal supplier of the British consuming market and the second largest producer of copper in the Western World in 1954. During the summer months there was a 45-day strike at many of the leading U.S. mines. Finally, in December, the Chilean copper industry was struck for the last three weeks of the year.

Only in the second quarter of 1955 did all the principal mining regions of the world operate without serious interruption. In that quarter mine production outside the Iron Curtain area amounted to 693,000 short tons—an annual rate of 2,773,000 tons, while refined production amounted to 717,000 tons—an annual rate of 2,858,000 tons. If these figures are compared with the actual output for the whole year, it can be estimated that strikes caused a loss in production of at least 150,000 tons.

One major executive in the copper industry, in discussing these interruptions, remarked that in any year one must look forward to a loss of 5% due to strikes or similar factors. If this is true for copper, it was not true for other non-ferrous metals in 1955. There were no serious strikes in the zinc or aluminum industries; domestic lead smelting and refining activity was curtailed by a strike in the third quarter but most mining operations were not affected and the accumulated tonnages of lead concentrate were converted into metal later in the year.

As the year ended, effective capacity of the industry had been increased to more than 3-million tons of copper annually. High prices certainly give operators every incentive for running their plants at maximum output during 1956. In the light of experience in 1955, however, how can one predict what proportion of the effective capacity will actually be utilized?

Among the major copper projects completed during 1955, special mention should be made of the White Pine and San Manuel mines—the two remaining major domestic projects undertaken at Government request and with Government assistance during the Korean War. San Manuel mine actually will not be in full operation (70,000 tons copper a year) until the second half of 1956, but the mill was running during the fourth quarter and it is understood the furnaces at the smelter were first tapped at year-end.

Another major producer, the Gaspe mine of Noranda, began milling operations during 1955, but full capacity has not yet been attained due to delays in securing power.

The roster of copper projects under way is a long one. Among the brand

new mines are Pima in the U.S.; Granduc and Geco in Canada; Bancroft and Chibuluma in Northern Rhodesia; Toquepala in Peru; Indio Muerto and La Africana in Chile. All of these are likely to be sizable producers. The time and money required to bring them into production is substantial. It will be at least 1960 before they are all supplying copper.

In the meanwhile, however, copper in the 40-50c price range is bringing in a host of lesser projects for which the capital expenditure is less and the time involved in getting into production is shorter. Since these smaller ventures will not provide their own smelting or refining facilities, a potential bottleneck may develop in processing capacity which is already being fully employed in most areas.

Looking at the demand side, one can safely conclude that had there been more copper available in 1955 it would have been used. In this sense it is unfair to consider shipments to consumers last year as representing the demand for copper. All the metal that could be obtained (including some tens of thousands of tons originally destined for Government stockpile) was readily taken up by the fabricators of copper. Many of them, wary of high prices, attempted to operate on minimum inventories and were put in a most uncomfortable position when the unexpected curtailments in production occurred. Regardless of their expectation as to future price trends, the majority of consumers in the coming year are unlikely to try to reduce inventories again. The cost in terms of tax hazards and intermittent operations is simply too great.

Major factors in the high rate of copper consumption appear to be (1) the improvement in the European standard of living, which has for the first time created a market for consumer durable goods there similar to (if not so great as) the U.S. market; (2) the steady increase in the use of electric power (which in the U.S. is approximately doubling every ten years); (3) the record rate of automobile production in 1955; and (4) the record rate of home construction.

Substitution. Copper's share in these four fields of general economic activity was relatively well maintained in 1955 despite high prices. In some uses it has been threatened with serious competition from substitutes—in certain cases because its supply is considered undependable; in others because its price is considered too high. Undoubtedly copper retained certain markets because the potential substitute material was also in short supply —the substitute being aluminum.

How effective aluminum's competition might be in certain directions was dramatically illustrated late in 1955 when the Aluminum Company of America was the successful bidder to the TVA for replacing high-voltage copper cable with aluminum. On this job, involving 100 miles of line, Alcoa agreed to take over the copper cable as scrap, provide the needed aluminum cable, and make a cash-payment to TVA of more than $100,000. Thus the Government got a new cable free and more than $1,000 in cash for each mile of line!

Of course the comparative arithmetic is not equally unfavorable to copper in most applications. Perhaps the majority of the applications of the red metal are in fields for which there is no effective substitute; or at least none is as yet known. Thus, despite costly research over a period of years, the automobile industry has not yet found a way to substitute other materials for copper in the radiator of a car. And, despite the publicity given to the substitution of aluminum for copper in telephone conductor wires, the greater bulk required for aluminum almost certainly makes its use in the telephone system impracticable in congested metropolitan areas.

Primary Copper Statistics*

(Tons)

	1953	1954	1955 estimated
1. U. S. mine production	937,318	863,721	1,045,000
2. U. S. imports of copper in ores and concentrates	120,889	118,586	130,000
3. U. S. imports of copper in blister	273,610	251,918	240,000
4. U. S. refined production	1,395,003	1,311,031	1,450,000
5. U. S. imports of refined copper	274,777	215,047	200,000
6. Total U. S. supply (line 4 plus 5)	1,669,780	1,526,078	1,650,000
7. Deliveries to U. S. fabricators	1,443,719	1,208,755	1,440,000
8. Refined exports from U. S.	109,510	215,950	200,000
9. Foreign mine production	1,441,874	1,494,386	1,580,000
10. Foreign refined production	1,120,066	1,155,516	1,350,000
11. Deliveries to foreign fabricators	831,441	1,247,120	1,305,000
12. Total world mine production (line 1 plus 9)	2,399,192	2,358,107	2,625,000
13. Total World refined production (line 4 plus 10)	2,515,069	2,466,547	2,700,000
14. Total World deliveries to fabricators (line 6 plus 11)	2,275,160	2,455,875	2,745,000
15. Refined stocks, end of year	369,723	228,637	220,000

* These statistics are based on those of the Copper Institute. Included in refined production is some copper derived from scrap and this is the chief reason for the discrepancies between Lines 12 and 13. Deliveries to stockpile are not included in line 14, but some deliveries from stockpile are included therein. This accounts for the decrease in stocks in 1954 (when heavy quantities of Chilean copper were purchased by the U.S.) even though production apparently equalled shipments; it also accounts for the fact that stocks were maintained about unchanged in 1955 even though production was apparently less than shipments.

To summarize: 1. Mine production of copper outside the Iron Curtain area in 1955 was 2,625,000 tons—about 8½% more than was produced in the best previous year (1953).

2. Deliveries of refined copper (including the relatively small amount of copper recovered from scrap by primary refineries) to fabricators outside the Iron Curtain area was 2,745,000 tons in 1955—about 12% more than best previous year (1954).

3. Prices of copper realized by the producers were the highest in modern times.

4. Both production and shipments of refined copper would have been greater than they were in 1955, had not labor disputes interfered.

5. At the end of the year mine capacity had been increased to a point which would permit a further 14% increase in output in 1956.

Outlook. How will copper do in 1956? The answer will depend on these factors:

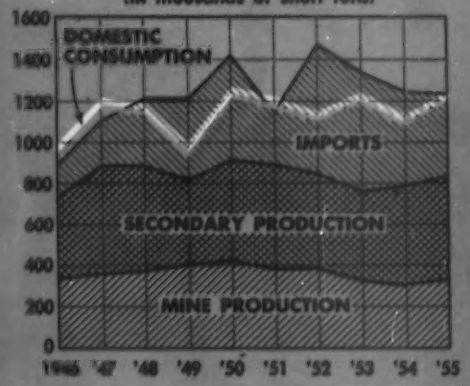
1. Will productive capacity be utilized?

2. Will world economic activity continue to increase?

3. Will substitute materials be more freely available?

4. Will consumers want copper at today's prices if the answer to question three is in the affirmative? •

Lead Supply and Demand in the United States[1]



(Short tons)

SUPPLY	1954	1955 estimated
Domestic ores	317,400	330,000
Foreign ores and base bullion	161,500	166,000
Secondary	480,900	490,000
Imports of metal	276,300	264,000
Total	1,236,100	1,250,000
Stocks at primary smelters and refiners	5,500 (Incr.)	50,000 (Decr.)
Total supplies	1,230,600	1,300,000
DEMAND		
Industrial consumption	1,095,000	1,200,000
Consumers' stocks	7,100 (Incr.)	—
	1,102,100	1,200,000
For stockpile and unaccounted for	128,500	100,000

(1) American Bureau of Metal Statistics and U. S. Bureau of Mines.

LEAD

Robert L. Ziegfeld
Lead Industries Association

THE LEAD INDUSTRY in 1955 picked up momentum as the year progressed, starting with a moderately good consumption rate and winding up with consumption at near record levels. Mine and secondary production and imports of concentrates showed increases, while imports of pig lead were lower; the total supply in the United States being about the same as in 1954. However, producers dug substantially into their inventories to meet the rising demand of industry and stockpiling.

Price. The domestic market experienced only two price changes in 1955, an advance from 15c to 15½c New York on September 26 and another from 15½c to 16c on December 29. The lead market ended the year on an extremely firm note both here and abroad. The London price at the year-end was the highest since trading reopened on the London Metal Exchange in 1952. The domestic price was also the highest since 1952.

The Government continued its stockpiling policy, announced early in 1954, of asking each month for stockpile offerings of domestic lead and buying at the market. In this way it added about 80,000 tons to the permanent stockpile in 1955, but most of this was accumulated during the first half. Starting with August, consumption was so high and producers' stocks so low that only token offerings were made for the stockpile.

Total production in the United States approximated 330,000 tons in 1955. Encouraged by better prices for both lead and zinc, American miners reopened several mines and increased production by about 5 per cent, despite some strikes. One in the Coeur d'Alene district of Idaho, affecting practically all but the largest producer in that area, started in August and had not been settled late in December. At least 5,000 tons of lead production was lost.

Production from secondary sources remained at a high level and amounted to about 490,000 tons, an increase of less than 10,000 tons. This is close to the 1947 record of 512,000 tons.

Imports of ore and concentrates slightly exceeded 1954 and amounted to about 165,000 tons, highest for any year. Imports of lead metal, however, showed a decline of some 12,000 tons from 1954 and totaled about 264,000 tons, a little more than half the peak metal imports which occurred in 1952.

Sustained improvement in the business abroad has been able to absorb sufficient foreign lead to keep it from depressing the American market. For instance, lead consumption in the United Kingdom was some 10 per cent higher than in 1954, and as in the United States, the highest rate was attained in the last few months.

Total supplies in the United States were about 1,250,000 tons against 1954's total of 1,236,000. However, producers reduced stocks of lead by about 50,000 tons, making the total available to industry and Government in the neighborhood of 1,300,000 tons. At the end of 1955, producers' stocks of soft and antimonial lead were about 30,000 tons, the lowest since 1952. This, coupled with high industrial consumption toward the end of the year, accounted for the small offerings to the Government for stockpile during recent months. Consumers' stocks changed little during 1955, and at the year-end, were about 90,000 tons, less than a month's consumption.

Consumption for the whole year was bright. At just about 1,200,000 tons, it exceeded 1954 by nearly 10 per cent and almost attained the record levels of 1950 and 1953. In fact, had the rate of consumption of the last five months been maintained throughout the year, new records would undoubtedly have been set.

Reference to the table of lead supply and demand shows that lead was in close balance when additions to the stockpile are considered. However, the table does not reveal the fact that the heavy demand occurred in the latter part of the year, accounting for

Use of Lead in the United States[a]

(Short tons)

	1954	1955 estimated
White lead	19,000	20,000
Red lead and litharge (b)	76,500	85,000
Storage batteries	337,300	378,000
Cable	127,900	122,000
Building (c)	52,800	62,000
Tetraethyl lead	160,400	164,000
Ammunition	40,200	47,000
Foil	4,400	5,800
Bearing metal	27,200	34,000
Solder	71,100	90,000
Type metal	25,700	26,000
Calking	49,900	58,000
Other uses	102,500	108,200
	1,094,900	1,200,000

(a) Based on U. S. Bureau of Mines statistics.
(b) Exclusive of oxides for storage batteries.
(c) Chiefly pipe, sheet and extrusions. Includes lead used in chemical construction.

Lead—Average Monthly New York Price

(Cents per pound)

	1953	1954	1955
January	14.192	13.260	15.000
February	13.500	12.818	15.000
March	13.404	12.935	15.000
April	12.683	13.904	15.000
May	12.750	14.000	15.000
June	13.413	14.106	15.000
July	13.686	14.000	15.000
August	14.000	14.058	15.000
September	13.740	14.598	15.100
October	13.500	14.965	15.500
November	13.500	15.000	15.500
December	13.500	15.000	15.558

the strengthening of the market then.

Uses. Most significant uses of lead generally increased. In the first 10 months, the storage battery industry, largest lead consumer, shipped 19,969,000 replacement automotive batteries, 1,000,000 more than in the same 1954 period. On that basis, shipments for the full year are estimated at 24,000,000, second largest year on record. Lead consumed by the entire battery industry is estimated at about 380,000 tons, an increase of more than 10%.

The trend is from 6- to 12-v batteries in more and more cars and these use about a third more lead each than the 6-v battery. However, newer alloys and better methods are making thinner plates and longer lived batteries possible, which tends to compensate for the larger amount of lead in the 12-v battery. The trend in battery grid alloys is to lower antimony and higher lead content with additions of small amounts of silver and arsenic.

Tetraethyl lead as an anti-knock ingredient for gasoline continued its steady growth despite full-scale operation of a new plant to make it in England, which took over some 20,000 to 25,000 tons a year of the United States export market. Another plant is now under construction in Canada. These new plants in other countries naturally affect the amount of lead used domestically but at the same time, they are an indication of growth in use of tetraethyl lead in other parts of the world.

There has been much talk of the eventual development of commercial gas turbine engines for automobiles which would use low grade fuels containing no lead, but it seems generally felt that even if such a development does take place at all, it will be many years before the conventional piston engine can be completely displaced.

Cable sheathing is one lead product that ran counter to the trend, declining about 6,000 tons or 5%. Here there is intense competition with newer types of sheath for both telephone and power cable, but the great growth of the public utility plants still demands a substantial tonnage of lead.

The building industry, including chemical construction and calking lead showed an increase in lead consumption of more than 15%. Ammunition and foil also increased.

Despite efforts over the years to find other means of joining metals, some of them successful, the use of solder continues to grow. In 1955, about 90,000 tons of lead were used to make this product, an increase of more than 25% over 1954. Undoubtedly, record production of automobiles and great growth of the electrical and electronics industries are important factors.

There are some developments that do not show up clearly in the statistics. For example, there are no separate figures available on the use of lead as a nuclear shielding material, yet it is known that a considerable tonnage is used. This application should grow with the atomic industries, particularly where shielding has to be portable and thus of minimum weight and size. Shielding for submarines, ships and the transportation and use of radio isotopes are examples.

Another industry with possibilities of greater lead consumption is the ceramic industry. Porcelain enameled aluminum, using high percentages of lead in the enamel, is a rapidly growing new development. The same enamels are now advocated for decoration of stainless steel. The trend in the ceramic industries is toward lower firing temperatures, generally accomplished by the addition of lead to ceramics. And lead imparts useful electrical properties to many ceramics used in electronic and similar uses.

Outlook for lead in the near future would seem to be closely linked with the trend of business in general, since there appears to be no new development that would suddenly displace lead in any of its important applications. A substantially lower rate of activity in the automotive and building industries would have some effect but with a record number of cars on the road, tetraethyl lead and replacement storage batteries should cushion any depressing effect.

From the supply side, while important new zinc-lead deposits are being developed, they are mainly zinc producers and should not create an oversupply of lead, particularly so long as foreign business remains healthy and growing. Furthermore, it should be remembered that a falling off in consumption could still leave lead at a relatively high rate since activity was at such a high level in the latter part of 1955 as compared with the early months of that year. Also the Government still appears to stand ready to buy for the stockpile. It has

purchased only about 144,000 tons in 1954 and 1955 under the program announced early in 1954 when the President said it could buy up to 200,000 tons of lead.

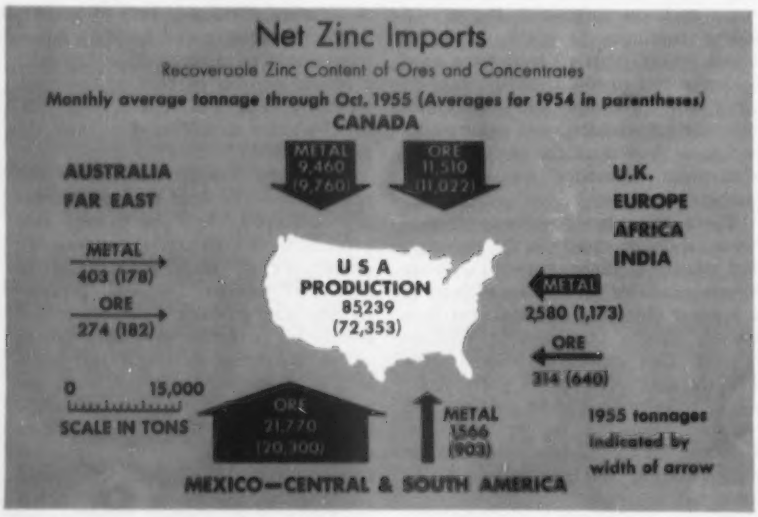
All in all, the picture for lead in the immediate future looks promising. Nevertheless, these are highly competitive times and no industry can afford to sit back and take the future for granted. Concerted efforts to protect old, and develop new markets are always necessary. For example, aluminum and plastics offer stiff competition in the field of cable sheathing; a switch to aluminum radiators in automobiles could affect the market for lead solder; gas turbine automobile engines might some day have a major effect on tetraethyl lead. On the other hand by keeping a step ahead of competition, lead, with its great variety of interesting properties, both as a metal and as a chemical compound, can look forward to a healthy future in the long run•

ZINC

Charles R. Ince
St. Joseph Lead Co.

THE ZINC INDUSTRY during 1955 broke all records for production and consumption. Spurred on by the highest rate of industrial activity this country has ever known, consumption reached an all-time high of over 1,050,000 tons. Under the impetus of this demand and rising prices, smelter production also achieved new heights and established a peak output in excess of 1,000,000 tons—not even surpassed by the previous high of the war years. Even pricewise, although advances were moderate—totaling less than 15%—the market hit a three-year high of 13c per pound.

Consumption as usual followed the pattern of general industrial activity. As the Federal Reserve Board index rose steadily during the first half of the year from 132 to 139, requirements for zinc rose likewise and by mid-year were running over 90,000 tons a month. Except for a seasonal decline in July due to vacation shutdowns at fabricators' plants this rate or higher was maintained for the balance of the year in line with the Federal Reserve Board's index subsequent rise to the 140-144 range. Total consumption for the year is estimated at 1,060,000 tons, an increase of 22% over the previous year. All consuming industries shared in the improvement. As in previous years the bulk of slab zinc consumption was divided between galvanizing and die casting, these two industries accounting for over 75% of the total consumption.



Galvanizing, largest user of zinc, accounted for around 430,000 tons, an increase of more than 10% over the previous year. This does not tell the whole story as it was evident that if the steel were available a greater tonnage would have been taken. The feature of the galvanizing industry during the past year was the further increase in use of the continuous galvanizing process. At the year's end, 26 of these lines were in operation with 2 under construction and 9 on the planning boards. Continuous lines now account for nearly 75% of galvanized sheet capacity. This relatively new hot-dip process produces a superior galvanized product eminently suitable for stamping, drawing, spinning and forming. The zinc coating is remarkably adherent, giving the properties of the base metal to the coated product, and the product is available in coil form for continuous feeding into automatic equipment.

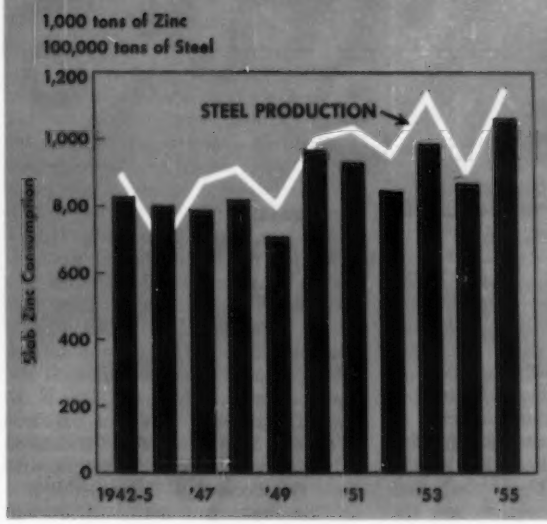
Die casting and zinc-base alloys, second largest user of zinc, pushed galvanizing for first place by consuming close to 400,000 tons, a sharp increase of 36%. There is no doubt that the biggest user of zinc die castings this past year has been the booming automobile industry with its more than 8,000,000 car production. This use of die casting accounts for at least 60% of the industry's output with another 15% going into the appliance industry. The 1956 models coming off assembly lines are using 10% to 15% more die castings by weight than last year's models. Consequently, even if there is a decline in automotive production this year we can expect the die casting industry to hold close to last year's rate.

The brass industry held its position as third largest user of zinc and accounted for 145,000 tons, an increase of 35% over 1954. Brass is a basic constitutent in American industry and the increase reflects the marked rise in all phases of the economy during 1955. Part of the increase was due to renewal of military contracts which had been curtailed or canceled the previous year.

Rolled zinc, an important but minor use of the metal, accounted for 53,000 tons last year as compared to 46,000 tons the year before, a rise of 18%. The increase is mostly attributed to the general uses such as production of

Slab Zinc in the United States

Consumption



Supply and Demand

Tons	1954	1955†	
SUPPLY:			
U. S. Primary & Secondary production	868,000	1,025,000	
Imports	157,000	160,000	
	1,025,000	1,185,000	
Less exports	28,000	19,000	
Less Government account	109,000	87,000	
	888,000	1,079,000	
CONSUMPTION:			
Galvanizing	399,000	430,000	(+ 8%)
Die casting and zinc-base alloys	287,000	390,000	(+36%)
Brass products	107,000	145,000	(+35%)
Rolled zinc	45,000	53,000	(+18%)
Oxide plants	18,000	22,000	(+22%)
All other	15,000	20,000	(+33%)
	871,000	1,060,000	(+22%)
SURPLUS	17,000	19,000	

†Last 7 months estimated.

dry batteries, engravers' plates, jar caps, weather stripping and roofing and building materials, but part of the gain is no doubt due to the growing use of High Grade zinc in rolled or cast form in anodes for cathodic protection of underground or water-immersed steel structures.

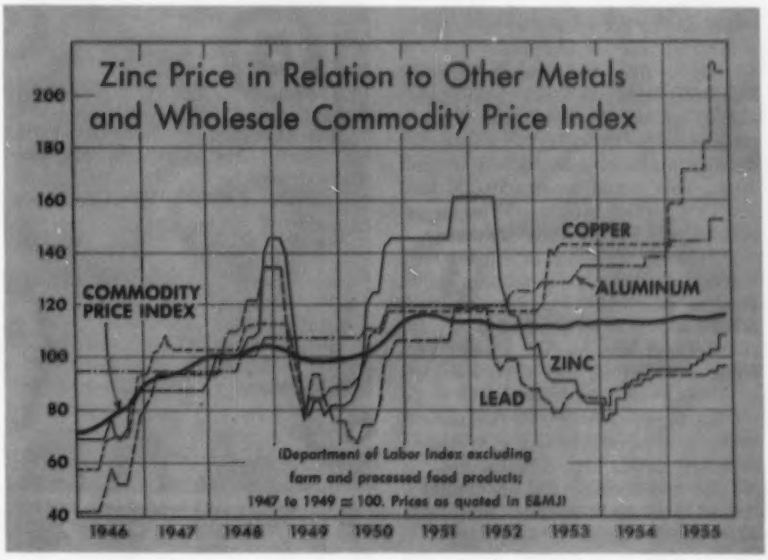
Direct use of metal for zinc oxide (French Process) amounting to 22,000 tons was up 20% as compared to the previous year. In addition to slab zinc used for this purpose, approximately 110,000 tons of zinc in the form of ore and other zinc-bearing materials were used for direct production of American Process zinc oxide. This latter use was also an increase of 20% and reflected the higher new car tire production as well as improvement in the paint industry.

On the supply side, domestic smelters, including secondary production, turned out 1,025,000 tons—a new record. This was 18% higher than the previous year and was nearly sufficient in itself to take care of domestic consumption without the necessity of metal imports. These amounted to around 190,000 tons and accounted for the major part of the surplus of metal supplies over requirements which existed throughout the year.

While zinc supplies as such were more than adequate there was an unbalance among the grades. Due to heavy demand for Special High Grade by the rapidly expanding die casting industry, there was a shortage of this grade and an over-supply of lower grades. Imports of the high-quality metal partially rectified this situation. At the year's end several domestic smelters had either increased their production of Special High Grade or announced plans to do so which gave promise of adequate supplies in the future.

Stockpiling was a material factor in the zinc market throughout the year. Nearly 90,000 tons of the year's surplus went into stockpile, most of it in the first six months. Of the 300,000-ton original objective it was revealed by Government officials that 181,000 tons had been acquired through July 1st. Another 10,000 tons have probably been purchased since that time, leaving about 100,000 tons to go.

Despite record high consumption it is hardly likely that the zinc market could have advanced and sustained the



increase, had it not been for this program of the Government's which was instituted in 1954 in lieu of tariff protection requested by domestic producers. However, at the year's end it was becoming increasingly evident that Government stockpiling was not accomplishing its avowed purpose of "maintaining an adequate mobilization base" in the domestic mining industry. The program has appeared to benefit foreign producers more than domestic miners. Imports of concentrates and metal were close to 660,000 tons and exceeded the output of domestic mines. U. S. mine production at 507,000 tons during 1955 was up less than 10% over the previous year and was still considerably below the more than 600,000-ton a year rate the mines were turning out prior to 1953. These figures indicate our growing dependence on foreign supplies which should be of some concern to consumers. Periodically, as in the recent case of copper, markets abroad have been more attractive to foreign shippers to the detriment of domestic fabricators. Such occurrences emphasize the necessity of building up and maintaining adequate domestic metals sources.

Outlook. As to the future, it is anticipated that both production and consumption of zinc will continue at high levels into 1956 but whether or not more records will be broken is difficult to estimate. At the end of the year there were signs of some cutback in automotive production. Furthermore, steel had been operating at close to 100% of capacity for several weeks and could be expected to decline somewhat. As these two industries are major outlets for zinc, a decline in either one or both could be reflected in a drop in zinc consumption.

Judging from the forecasts in these industries, however, such adjustments should not be too drastic and it is not unreasonable to estimate a possible decline in zinc consumption of around 10%. This would mean 950,000 tons for 1956, which would still be an excellent year by pre-1955 standards.

Pricewise, we might expect a strong market even though a surplus might exist as it did in 1955. The Government's apparent willingness to buy for stockpile at the market should preclude any decline, and increased costs of mining and smelting could force the market up. It might be pointed out that zinc is not out of line with respect to other metals and commodities. At its year-end level of 13c per pound it was 90% of the Wholesale Commodity Price Index compared with copper at 180%, aluminum 129%, lead 87%.

TIN

George H. Cleaver
Market Editor

THE MAJOR UNCERTAINTY in the tin market as 1955 ends is what the U. S. Government will do with the Texas City tin smelter.

A comparison of the production of tin-in-concentrates with consumption of primary tin suggests the former is in excess of the latter by about the amount which goes into the U. S. Government stockpile. Important in getting a conclusion on the situation on tin during 1956 are: (1) Will the Texas City smelter continue in operation (2) will the U. S. Government continue to stockpile tin (3) will the economies of the U. S. and Europe continue to operate at the present high levels—the highest in history? There are other important questions, mainly on the supply side, which need to be considered.

U. S. Stockpile. If the U. S. Government ceases stockpiling, the supply of tin-in-concentrates will be far above consumption. If the Texas City smelter should continue to operate in private hands and the refined metal be sold on the market, the supply of refined tin will doubtless be well in excess of needs. There is little doubt the stockpile objective will be reached by the middle of this year when the Texas City smelter is scheduled to cease operations. Moves were made in the past year to turn it over to private firms but their interest, based on the tin market here, and the uncertainty of high grade concentrate supply, did not appear great though they apparently believe it a good plant. But the tin stockpile objective has been met before and each time it has been extended. Some suggest this is a result of a reassessment of the stockpile needs but most claim two other considerations are dominant and that they may apply again. One is the State Department view that purchase of tin ores from Bolivia and Indonesia helps to maintain close relations with these two countries. The other is that no Congressman wants an industry in his state to stop or move elsewhere, and therefore Texas members of both the smaller and larger House will perhaps successfully get operation of the smelter extended and the stockpile objective expanded. There is little doubt the Administration will oppose it, as it did in the past, but in an election year it may be even less disposed to resist strongly a move to extend it. If this is done, and there is no major recession in the economy, tin miners and smelters can expect good prices to remain through the year.

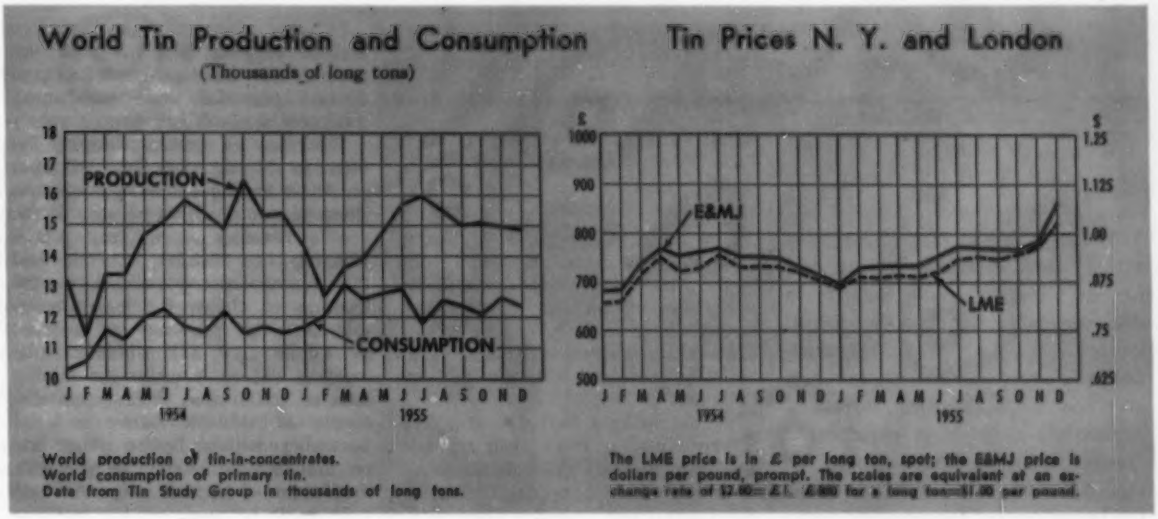
On the assumption the U. S. does not continue to stock tin and the Texas City smelter ceases operations, an excess of tin-in-concentrates will be available. With greater smelter capacity which has just been put in place in Malaya and the great capacity in the U. K. and the Netherlands, there could easily be a considerable excess of refined tin coming onto the market before 1956 ends. Without a production control scheme, prices could fall to the point where the high cost producers of concentrates would have to cease production. The effect on some of the smelters could also be unpleasant.

International Tin Agreement. The International Tin Agreement (see last paragraph of February 1955, tin review) was originally proposed and is still advocated to prevent this type of situation from occurring. Only Indonesia needs to ratify the Agreement in order for an organization to implement it to be set up. The proposed Agreement is essentially a price control ar-

Primary Tin Statistics

(Long tons)	1954	1955
World mine output.....	174,500	175,500
World consumption...	138,200	149,500
World stocks:		
Gov'ts included...	(a) 353,000	(a) 378,500
Gov'ts excluded...	(b) 72,000	(b) 65,000
U. S. consumption...	55,000	60,700
U. S. import (pig).....	65,600	64,500
U. S. output (pig) at Texas smelter..	27,150	22,327
Price, av., N. Y. prompt..	91.838c	94.735c
Price, av., London, cash.....	£719.5	£740.1

(a) This estimate was arrived at by adding to the International Tin Study Group figure for the end of 1947 of 135,000 tons, the excess output over consumption each year. (b) I.T.S.G. figure.



rangement, the price to be controlled by a centralized authority altering the amount of metal offered on the world market. If the price dropped to 90c a lb the organization's directors could buy up tin in order to prevent further price declines. With tin at $1.00 it could sell tin to prevent further price rises. At $1.10 it presumably would be required to sell to prevent further price increases and at 80c a lb it would be required to buy to prevent further price declines.

The propriety of control schemes has been argued for decades and was brought up in connection with tin. This issue has not died. Consumers remain skeptical and some of them feel price control on the top side is largely a concession to reduce opposition, though others point out high prices are detrimental to the producing industry in that they encourage replacement by other materials. They suggest the producing industry would limit the price to $1.10 in order to keep consumption high enough to prevent a low and unprofitable level of operations. Some suggest smelting firms are less concerned than mining firms.

Some factors feel such an organization is in opposition to the fundamentals of a free enterprise capitalist economy. The successful operation of a free capitalist economy, and especially of its dynamic character, they contend, is dependent on a continual adjustment of the industries (and firms) brought about by changes of demand and supply of products and the resources from which products come. In such a system unfavorable cost developments bring about the movement of resources from one industry to others, or favorable cost developments bring more resources into the industry. The same sort of thing occurs between firms within an industry, with the firms whose costs rise the most more likely to contract output or be squeezed out of business. On the demand side, shifts of demand away from the industry lead to contraction with the the higher cost firms usually contracting output most. This process makes more resources available to industries and firms that are expanding.

A control system is designed to reduce or level out the amount of product reaching the market, usually by putting some into a stockpile (U. S. agriculture, etc.). Unless a system of controlling output is built into the arrangement, its ultimate success is doubtful. In the long run prices determine the amount of output. If the prices at which the organization sells from its stockpile are not high, and the prices at which it buys and thus accumulates are low, the chances of successful operation of the arrangement will be fairly good. This may be put more precisely: these prices need to be set low enough so that over the long run—a period of years—output will equal consumption, or at least exceed it only by a specified amount, the maximum permitted in the stockpile.

In order to arrive at such prices many variables need to be considered, and it is possible the buying and selling prices would need to decline progressively. This is likely to be necessary if there is a secular trend away from the industry, or the costs in the industry decline relative to those in other industries. A long run inflation could offset such conditions making it possible to keep the prices originally set and still encourage contraction of the industry; the higher cost firms and areas reducing output.

The flexibility in the proposed Tin Agreement indicates awareness of these matters though there is some uncertainty the prices set will satisfy all members a few years from now, or accomplish the objective. If industry contraction should ever become necessary a demand for revision of the quotas could lead to a conflict upon which the Agreement could founder. Low cost areas could decide to go it alone, especially if political groups felt it would be a good rallying cry. Would the Agreement withstand the stresses of a recession lasting several years?

Underdeveloped countries, such as those where most tin is mined, normally do not have industrial diversification which would permit easy transfer of resources to other industries if one needs to contract. This can lead to operations continuing with great drops in price. Many feel the price mechanism is not likely to work well in contracting output in case of a demand decline.

Tin in 1955. The tin market strengthened almost continually throughout 1955. January N. Y. average price was 87.3c and the price for December was $1.078. This strength was largely based on the high demand accompanying expanded economic activity in the U. S. and Europe. But uncertainty of supply also had some effect. The prospects of an intensification of the "little war" in Malaya and the increasing tenseness in the Near East with the possibility of an increase in hostilities and shipping problems contributed to the higher prices•

URANIUM

Jack Kratchman
U. S. Atomic Energy Commission

1955 HAS BEEN a year of intensive activity and extraordinary success for the uranium mining industry in discovery of new deposits, record levels of ore and concentrate production, expansion of mill facilities and the application of improved processing methods. Concurrently, "boom" thinking has begun to be replaced with mature inquiry into the problems and future of uranium mining.

The first International Conference on the Peaceful Uses of Atomic Energy took place, under the auspices of the United Nations, at Geneva, from August 8 through August 20, 1955. One hundred and twenty-eight papers summarizing prospecting methods and the natural occurrence of uranium and thorium were presented.

In addition to describing many deposits throughout the world, these papers contain the first assemblage of technical information on the natural occurrence of uranium and thorium in various rock types and geologic environments. Of particular interest, because of immediate applicability are the discussions of methods and techniques of exploration. In addition, numerous manuscripts on processing uranium ores and on the various aspects of nuclear fuel applications were submitted.[1]

Domestic Developments. Significant uranium discoveries, both in old and new producing regions, were the outstanding domestic developments during the past year. Increased efforts by industry resulted in the discovery and development of deposits in McKinley County, New Mex.; Stevens County, Wash.; Saguache County, Colo.; Karnes and neighboring counties, Tex.; Slope and Billings Counties, N. Dak.; and Lakeview County, Ore. These new discoveries extended the areas of deposition both in geographic space and geologic time.

A major discovery was made in the Ambrosia Lake area approximately 20 mi north of Grants in McKinley County, New Mex. Although only vague preliminary results are available indications point to development through large scale drilling by private concerns, of reserves which may eventually be measured in several millions of tons.

On the Spokane Indian Reservation, Stevens County, Wash., primary and secondary uranium minerals are found at or near the flat dipping contact of the Loon Lake and the Deer Trail argillite. The mineralization fills fractures at or near the contact in the metamorphosed sediments of Paleozoic age. Similar, but less extensive contact deposits are being explored near Austin, Nev.

Hydrothermal pitchblende-bearing veins are being developed by the Los Ochos mine near Gunnison, Colo. Pre-Cambrian granites and schists, overlain by Jurassic and Cretaceous sediments, are cut by fault zones. It is the intersection of the main, east trending, Los Ochos fault with northeasterly cross faults which has localized the ore in pipe-like bodies. Prospects at other fault intersections in the district are being explored, although they don't seem to be as great.

Commercially important tonnages of ore have been discovered in three tuffaceous horizons of Middle Tertiary age in the Gulf Coastal Plain of southwest Texas. The sediments in which the uranium minerals occur outcrop for 150 mi along the Gulf Coast. Largest deposits are located in Karnes County and consist of secondary uranium minerals disseminated in a tuffaceous sandstone. Oil company participation in uranium exploration is particularly intense in this area.

Large tonnages of uranium-bearing impure lignites have been discovered in South Dakota, North Dakota and Montana. Uraniferous lignite is largely confined to the Paleocene, Fort Union formation with the major uranium values occurring as a urano-organic complex disseminated in the carbonaceous material. Permeability of the enclosing beds appears to have affected the localization of uranium. Experience gained from the earlier discoveries in 1954 in the Slim Buttes and North Cave Hills areas of South Dakota suggests that the new discoveries may have an important production potential when satisfactory treatment methods are worked out.

Discovery of uranium-bearing lignites in North and South Dakota created a legal problem in the acquisition of mining rights because of the conflict between mineral leasing laws affecting non-metallic minerals and the mining laws pertaining to the location of claims for metalliferous minerals. This problem was resolved by Public Law 357 which permits location and entry under the mining laws of the United States upon discovery of valuable source material occurring within lignite. The law requires that the location be filed with the Bureau of Land Management and a payment be made of 10c per ton of mined lignite. Only limited tonnages of lignite are now being acquired by the AEC for metallurgical tests.

Tertiary lake bed uranium deposits of lesser importance than those described above, have been discovered in California, Nevada, Arizona and Montana. Production has been small but the widespread distribution of Tertiary lacustrine deposits in the western United States recommends many areas for reconnaissance.

The first potentially important discovery of uranium in Oregon was made near Lakeview, Lake County. Secondary uranium mineralization, associated with traces of realgar and orpiment, is controlled by minor faulting in brecciated, altered, tuffaceous beds.

Exploration. Expansion in private exploration and drilling, and the accompanying rise in discovery rate and ore reserves has enabled the Commission and the USGS to redirect their exploration programs. The objective is greater emphasis on the development of principles of uranium geology, to establish and test criteria and methods for finding uranium in new areas and stratigraphic horizons, and to disseminate this information to the public.

Private drilling has continued to expand to an estimated 4,000,000 ft in 1955, with considerably more rotary drilling than core drilling. Greatest activity centered in the Big Indian Wash area, Utah; and the Ambrosia Lake district of New Mexico. Considerable bulldozing and drilling has been devoted to developing uraniferous lignite reserves in the Dakotas.

Over 20,000 hours of airborne surveying were completed in 1955 by non-Government operators. The first production of transistorized, field radiation detection instruments has

1 A list of papers may be had from the United Nations Library. Copies of papers may be obtained at 25c a copy from UN Bookshop, United Nations, New York 17, New York, until the supply is exhausted.

been obtained, and their expected superior performance promises valuable aid to the prospector.

Some other new devices or techniques being applied or studied are gamma ray spectroscopy for identification of radioactive isotopes, the use of tape recordings in gamma ray logging, and velocity logging instruments to interpret stratigraphy. Research continues on the application of airborne radiometric survey results to the solution of geologic problems, and the correlation of combined geophysical and geochemical data.

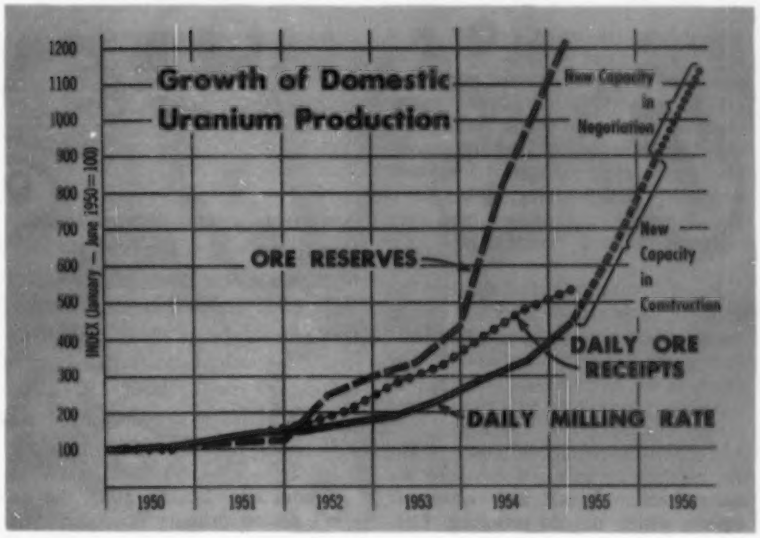
Processing. The potential uranium producing area of the United States is more extensive now than at any time in history of domestic uranium mining and the number of sites where producers may sell their ores will soon number seventeen. To handle a record production, new mills are under construction at Edgemont, S. Dak.; Moab, Utah; and Tuba City, Ariz.; contracts have been entered into for construction of mills at La Sal, Utah; and Maybell, Colo.; and nearly all existing mills have expanded.

New construction in 1955 is highlighted by the latest uranium ore processing methods. In the past, chemical precipitation or static beds of ion exchange resins, with subsequent elution and precipitation as a high grade concentrate, have been the usual means of recovering uranium from clear solutions. Unfortunately, many Colorado Plateau ores are difficult to clarify because they contain large quantities of argillaceous material, and research was directed to recovering uranium from pulp with no clarification of solution and only a prior sand-slime separation.

This research developed a new method called resin-in-pulp and 1955 saw the first operation of this process in two mills, and its installation in three mills under construction.

Progress towards improved methods is marked by the testing of a liquid-liquid solvent extraction process. This process is based on recovery of uranium from solutions utilizing organic solvents. The technique is being tested with clear solutions as well as leach slurries and at least one mill has installed a pilot plant.

Foreign Developments. There is no doubt that the unfolding of a major uranium field at Blind River, Ontario, Canada, is the most noteworthy foreign development of 1955. Extensive deposits of uranium-bearing, Pre-Cambrian quartz pebble conglomerate outcrop in a reverse S-shaped pattern for many miles. Deposits are like those of the Witwatersrand, except that gold is not present in important amounts.



Sufficient reserves have been proven to assure Blind River's place as a major uranium source for several decades. These reserves, when fully developed, appear capable of supporting a number of large milling operations. Pronto Uranium Mines' mill is already in operation, Algom Uranium Mines has announced construction of two concentrators to service its mines at Quirke Lake and Nordic Lake, and plans have been revealed by Consolidated Denison Mines to build a processing mill which will exceed the capacity of either of the Algom mills, and be the largest uranium mill in North America.

Marked increases in production were also obtained from the Beaverlodge area in the Lake Athabaska region of northern Saskatchewan. Construction of mill facilities in the Bancroft area of eastern Ontario is under way and will augment the larger operations in other regions.

In the Belgian Congo, the Shinkolobwe deposit continues to be an important source of uranium for the Free World. Production from South Africa increased and there are thirteen uranium processing plants now in operation with three others being built and a fourth under consideration.

Regular shipments of concentrates from Australia began in 1955, from the Rum Jungle plant and the Port Pirie plant which treats Radium Hill ores. Ores from the recently developed Mary Kathleen deposit, in the Mount Isa district of northern Australia, are expected to account for additional Australian production of uranium.

In Portugal, the Urgeirica mine maintained production. An extensive exploration program in continental Portugal was announced by the Nuclear Energy Board of Portugal. This plan is the initial phase of a program which envisions extending the area of search to the Portuguese overseas provinces.

Uranium orebodies are being worked in the Vendee and at Bois Noirs in the Central Massif of France.

Uranium prospecting activities in other parts of the world have increased. Reports of discoveries of uranium mineralization have come from such widely scattered points as the Prince of Wales Island, Alaska, the Philippine Islands and Peru. In Brazil, a cooperative exploration program of the United States and Brazilian Government is getting under way.

Outlook. All signs for 1956 point to continued high level of activity in the uranium industry. Discovery of important deposits, both in old and new types of environments, has opened up many areas for reconnaissance. In addition, intensive development and mining programs by larger mining companies and more active participation in uranium exploration by petroleum companies will undoubtedly mark the coming year.

Size and duration of military requirements or the timing of a large demand for industrial purposes cannot be predicted accurately. It may be after 1965 before substantial tonnages of uranium will be required for nuclear power applications. However, an intensive effort, both Governmental

and private, is being devoted on a world-wide basis to development of economic reactor designs and components, and competitive power reactors may come sooner than many observers now expect with an accompanying demand for considerable tonnages of uranium. Nuclear power is already feasible in areas where only high cost power is available.

Possible substitution of thorium for uranium in peacetime nuclear energy applications received much publicity during the Geneva Conference. The magic word "breeder reactor" suggested to many people that thorium would replace uranium as a nuclear fuel. Although research is continuing on the use of thorium in reactors, there are many technological and economic aspects which remain unsolved. Uranium appears likely to retain its place as the prime nuclear fuel for a long time to come. The success or failure of research programs devoted to thorium reactor technology will determine whether thorium will keep its present status or ultimately rise to supplement or compete with uranium.

Scientists have long been intrigued with the possibility of fusing nuclear material with an attendant release of energy. After the Geneva Conference some speculation was directed to the possibility that controlled atomic fusion might be developed to the extent that it would be usable as a source of nuclear energy for industrial purposes in the near future. Lewis L. Strauss, chairman of the Atomic Energy Commission, in announcing the sites engaged in the controlled thermo-nuclear program, interpreted the problem as follows:

"It cannot be stressed too strongly that, based on what we know, we are far from a solution of the problems of the controlled fusion reaction. Our work is in the research stage and many years of intensive effort may be required before the first prototype of an operating thermo-nuclear machine may be developed."

Although partial deflation of the uranium "boom" of 1953 and 1954 caused considerable pessimistic talk, no industry can be without problems and uncertainties. The uranium industry is certainly no exception. However, entrance of established management in the uranium mining industry, increased plant capacities, redirection of Government exploration efforts, and promise of nuclear power are among the signposts which mark the road of opporunity for the informed, the imaginative and the enterprising•

ALUMINUM

Irving Lipkowitz
Reynolds Metals Co.

ANOTHER YEAR—another production record—that has been the story of primary aluminum production in the United States four years running now. Domestic primary production in 1955 reached the record level of 1,565,000 tons—about 7% higher than in 1954, when the output was 1,461,000 tons.

Production. During 1955 the nation's newest primary producer, Anaconda Aluminum Co., completed its facilities at Columbia Falls, Mont., and the first of its two potlines began regular production in August. By the end of the year, Anaconda's 60,000-ton plant was operating at full capacity. With the completion of this plant, the capacity expansion program begun during the Korean War to meet mobilization requirements was brought to its conclusion. The result has been a 118% increase in United States primary production since 1950 when the total was 718,622 tons.

Primary aluminum production in the rest of the world also set a new record, rising about 8%, from 1,725,000 tons in 1954 to 1,865,000 tons in 1955. A significant development was Russia's relative slow-down as an expanding aluminum producer. In 1954, 34% of the world production increase was achieved by the Russian group but they accounted for only 18% of the 1955 increase. As a result, Russia and its satellites did not improve their relative position among the world's producers during 1955, their share remaining at the 17% level established in 1954. During 1954, however, their relative share had improved 3% over 1953, when they produced 14% of the world's primary aluminum.

World production would have been still higher, except for poor water-power conditions, particularly in Canada and Scotland. Canada had expected an 89,000-ton increase in production during 1955. Low rainfall and continued drought conditions in Quebec since summer have been the principal cause of a primary production loss estimated at 45,000 tons, cutting Canada's 1955 anticipated increase in half.

Another contributing factor was a power failure at the Kitimat, British Columbia, plant early in 1955 when a snow slide in a mountain pass caused a break in the transmission line to the reduction plant. Water shortages in Scotland also resulted in sharply reduced production—a 62% cut in September output, for example.

Imports and Exports. Net imports continued to decline during 1955, as they have since 1953. While the main reason for the drop in 1954 imports was a domestic supply in excess of demand during most of that year, throughout 1955 the United States market could have easily absorbed much more primary aluminum than was made available from foreign sources. It was the strong foreign demand which prevented a greater flow of aluminum into this country.

Impact of foreign demand on United States imports is reflected in the breakdown of shipments made by the principal source, Canada. Total export shipments of primary aluminum from Canada rose 47,600 tons during the year, from 475,200 tons in 1954 to 522,800 tons in 1955. About 92% of that increase went to Britain, which has a contractual first call on a large block of Canadian production. The United States market received only 1½% of the 1955 increase in Canadian export shipments.

Increasing foreign demand for aluminum, plus European prices generally higher than those here, have also brought a sharp shrinkage in primary imports from Europe and Asia. Already relatively small, these imports have been cut almost in half, from 18,500 tons in 1954 to 9,500 tons in 1955.

Similarly, scrap exports from the United States to Europe—though much below the 1954 level—were still rather substantial during 1955. With scrap imports higher and exports lower than in 1954, the gap between the two was greatly narrowed during 1955. In 1954, scrap exports (35,000 tons) exceeded imports (9,000 tons) by 26,000 tons. In 1955, scrap exports (19,000 tons) were only 5,000 tons higher than the imports (14,000 tons).

Bauxite Supply. While record production of primary aluminum neces-

sarily required an increase in bauxite consumption, the ore supply (domestic mine production plus imports) was about 5% less than in 1954. There was no lack of bauxite, however, for the aluminum and other consuming industries. Reduced 1955 supply reflected only the Government's decision to curtail stockpile purchases of bauxite.

Jamaica continued to improve its position as a major source of bauxite imports, with a 30% increase over 1954 in tonnage shipped to the United States. Imports from Surinam declined 26%. As a result, for the first time, U. S. Bureau of Mines reports show slightly larger bauxite imports coming in from Jamaica than from Surinam. In terms of recoverable aluminum, these bauxite import tonnages are not strictly comparable because Jamaica ore, as shipped to the United States, ordinarily has a higher free moisture and a higher iron content than does the Surinam ore. Combined imports from Jamaica and Surinam totaled 3,644,615 tons during the first nine months of 1955, making up 70% of the United States supply.

British Guiana was the only other regular source of bauxite imports for the United States during 1955, accounting for 3% of this country's supply. The 1955 shipments from British Guiana increased at an even higher rate than did Jamaica shipments, about 33%, according to comparative reports for the first three quarters of the year.

Continued interest was shown during 1955 in the development of processes for using domestic aluminum clays as an aluminum ore. During a Federal Power Commission hearing in September concerning natural gas supplies for the Pacific Northwest, Anaconda Aluminum Co. stated:

"We have long been interested in finding and developing a domestic source of mineral which would provide an economical and certain supply of alumina for our future electrolytic plant requirements. Our search for such materials in large quantities, and the research incident to beneficiation into acceptable grade aluminum, has now reached a stage where we have found and optioned, or otherwise acquired, clays in Pacific Northwest areas served by the Pacific Northwest Pipeline Corp. and have developed a beneficiation process for making alumina from such clays."

Raw Aluminum Supply. Primary aluminum supply available for United States consumption showed a net increase during 1955, despite continued decline of imports. The 7% or 104,000-ton increase in domestic production more than offset the 9% or 19,000-ton decrease in net imports, resulting in a net increase of primary aluminum supply over 1954, amounting to 85,000 tons.

Since 1950, with the sharp expansion of domestic capacity and production, the trend has been towards the domestic producers supplying an increasing portion of the primary aluminum used in this country. Back in 1950, they produced 80% of the total primary supply. By 1953 it was 81% and jumped to 87% in 1954 when the largest block of new capacity came into full operation. In 1955, domestic producers provided 89% of the primary supply.

Scrap supply, as in the case of primary, increased in 1955 chiefly because more was available from domestic sources. Supply of domestic scrap was increased by about 67,000 tons while imports went up only 5,000 tons. Because of exceptionally strong demand throughout the year and pressure of foreign purchasers, prices of scrap and remelt ingot were high, compared to those for primary. At the close of 1955, the prices of high grade scrap were above those for primary pig and remelt ingot was selling for 5 or 6c more than primary ingot.

Industrial Aluminum Shipments. The strong industrial demand during 1955, coupled with the absence of any military emergency, brought a sharp reduction in Government purchases of primary aluminum for the stockpile. Consequently, a much larger share was available for consumption by industry and the public.

Shipments to consumers during 1955 were slightly more than 2,000,000 tons, or about 35% higher than in 1954, partly because of less diversion to the stockpile and partly because industrial demand was much stronger.

Aluminum Supply in The U. S.

(Thousands of tons)

	1953	1954	1955 estimated
Primary			
U. S. production	1,252	1,461	1,565
Net imports (less exports)	299	216	197
Total primary	1,551	1,677	1,762
Domestic production—			
Percent of total	81%	87%	89%
Scrap (recoverable content):			
Domestic	369	327	393
Imports	24	9	14
Total scrap	393	336	407
Total primary and scrap supply	1,944	2,013	2,169

Aluminum Production

(Thousands of tons)

	1953	1954	1955 estimated
United States	1,252	1,461	1,565
Canada	546	561	605
Western Europe	496	557	595
Asia, Australia & South America	67	75	90
Free World total	2,361	2,654	2,855
U. S. S. R. & satellites	381	532	575
World total	2,742	3,186	3,430

During the first nine months of 1954, large quantities of primary aluminum went into the stockpile chiefly because supply exceeded demand. Throughout 1955, however, industrial demand remained strong enough to absorb all available supplies.

Significant feature of these increased shipments is that they are preponderantly due to the growth of regular peacetime markets. Shipments for direct military uses have declined sharply during recent years. The Korean War peak for such shipments was 396,500 tons—in 1952—absorbing 30% of that year's shipments (1,331,000 tons). By 1955, direct military shipments dropped to less than half what they were in 1952, or only 185,000 tons. They were responsible for 9% of the 1955 shipments. Shipments for civilian and indirect military uses accordingly almost doubled between 1952 and 1955, rising from 935,000 tons in 1952 to 1,840,000 tons in the past year.

Although, as a result of expansion of domestic primary production since 1950, shipments of all types of industrial aluminum (sheet, castings, extrusions, rod, foil, forgings, etc.) have increased, there has been considerable variation in their respective rates of growth. A 1950-55 comparison of the major product groupings shows the following increases in shipments during this 5-year period:

	Tons	Percent
Sheet	12,650	29.6
Castings	11,300	49.9
Extrusions	20,350	189.3
Rod, bar, wire, forgings	7,350	69.3
Foil	3,700	86.0

At the end of 1955, the extrusion group was still the most rapidly growing segment of the industry, with shipments about 55% higher than in 1954, as against the 35% average increase for all groups of the industrial aluminum products.

Market Development. The aluminum industry's continuous efforts to develop larger markets and create new ones bore considerable fruit during 1955. The strong demand is proof of aluminum's increasing popularity with both consuming industries and the general public. This growing popularity of aluminum is not confined to the United States. It has become a world-wide phenomenon.

Many conditions and circumstances are contributing to this development. First is the domestic aluminum industry's resourcefulness in assuring established and prospective consumers of an ever-increasing supply of aluminum. This assurance applies not only to supply of basic raw aluminum but also to the wide range of industrial forms or mill products. Actually, over 95% of the aluminum used has to be in some fabricated form to meet the customers' needs and less than 5% is used in its raw form.

This favorable supply condition is in sharp contrast to that prevailing in other metals industries which are dependent on imports for a much larger share of their basic metal supply. Political and economic policies of various foreign countries, such as Chile in the case of copper, frequently are more decisive than the policies of the domestic producers in determining what quantities will be available for United States consumption—and at what prices.

Aluminum has also been in a favorable position price-wise during 1955. Unlike many other metals, its price has been relatively stable, experiencing only two changes—a cent per pound rise in January and another cent increase in August. The total advance in price, 2c, from 20.5c per pound to 22.5c, compared so favorably with price rises for other metals (copper, for example, going from 30c to 43c) that aluminum has become the economy metal for a great many new applications.

Another major influence behind the expansion of aluminum's markets in 1955 was the growing utilization of anodized and other types of color finishes on aluminum products. For many years color-printed foil beer labels and food packaging were the only established colored aluminum products. Aluminum in color finishes then became widely used for venetian blinds and tumblers. More recently, its use has spread to building products (from roofing and siding to acoustical panels), refrigerator and other appliance components, automotive parts, furniture, toys and many other applications. A notable example is the gold-anodized aluminum grille featured on the 1956 Cadillac Eldorado, which model incidentally contains 197 lb of aluminum parts.

The continued and substantial growth of aluminum markets is widely predicted by the industry and by many of its major industrial customers. Supporters of these views have estimated that by 1960 the aluminum markets of this country will be at least 50% larger than they are today.

New Expansion. The industry's confidence in its future markets is strongly reflected in announcements made during 1955 by one company after another, of plans to build new primary capacity. These expansion plans provide for the construction of 700,000 tons of new primary capacity in the United States by three of the present producers and by four new producers. This would mean a 45% increase over present capacity and there would then be a total of eight domestic producers. At least 65% of the proposed new capacity is being planned on the basis of utilizing coal as a power source. These plans for new capacity are the largest the aluminum industry ever had under peacetime conditions. Unlike the Korean War expansion program, the current plans are based on regular peacetime markets, not on mobilization requirements. They reflect the industry's determination not to lose any future market possibilities for lack of adequate metal supply.

Plans for building more primary capacity are not confined to the United States. Canadian capacity is being expanded and the British producer is also reported to be planning a Canadian plant. A group of leading European producers have announced plans for exploring the possibilities of a large-scale development in Africa. These are but indicative of the optimistic and confident atmosphere in which the aluminum industry throughout the world is moving.

Outlook. British Aluminium Co., Ltd. summed up the world outlook for aluminum with these optimistic words in the concluding paragraph of its recently published history:

"Almost all industries now make some use of aluminum but it is clear that in many of them its potentialities have barely begun to be realized. It is not unlikely that the present rate of production will be doubled during the next twenty years while even ten million tons does not seem an impossible target for achievement by the end of the century."

All of the world's aluminum companies may not agree precisely with the British Aluminium Co.'s prediction as to the number of years it will take to double production or as to how many times world production will multiply by the end of the century. But they all undoubtedly do agree that, to supply future markets, the industry will once again double its output in a relatively few years and before the end of the century will have multiplied its present production many times over•

MAGNESIUM

J. D. Hanawalt
Dow Chemical Co.

THE MAJOR EVENT for magnesium in 1955 was its emergence as a predominantly civilian metal. Accounting for approximately 53% of total consumption, civilian applications exceeded military for the first time in the history of the American magnesium industry.

Consumption reached 65,000 tons (55,000 primary, 10,000 scrap and secondary), the highest for any peacetime year. The outlook for 1956 is for still heavier consumption.

Production. Four plants in the U. S. manufactured magnesium metal in 1955. Two sea water extraction plants at Freeport and Velasco, Texas, are operated by Dow Chemical Co. Magnesium metal also is produced independently in plants at Canaan, Conn., by the ferrosilicon reduction process and at Henderson, Nev., by electrolysis of magnesium chloride.

In 1955, Dow's magnesium rolling and extruding facilities at Madison, Ill., which had been opened in 1954, came into full operation. Mill products are now available in larger quantities and a wider range of sizes than has hitherto been possible in the industry. Sheet, previously available only in widths up to 48 in., is now being rolled in widths up to 72 in.

With the appointment by Dow of its fifth distributor, magnesium mill products are now available countrywide through local suppliers for the first time.

Developments. Some indication of where magnesium is going may be gained by reviewing the principal developments of 1955.

Magnesium truck bodies were produced on an assembly line basis for the first time when one of the largest body builders began producing a lightweight delivery truck containing nearly 400 lb of magnesium sheet and extrusions in the new monocoque (thick plate) design.

An all-magnesium F-80C jet fighter had its maiden flight in the East and was flown to the Air Force's Wright Air Development Center for final tests. The simplified monocoque design of this plane makes possible a 30% increase in fuel capacity in the wing cells, clean aerodynamic surfaces and fast construction.

Magnesium tooling plate, introduced in 1954, enjoyed a phenomenal growth in 1955. Sales increased sevenfold, and a further substantial increase is expected in 1956. Magnesium's light weight, excellent machinability and weldability make it a splendid material for tools and fixtures. Weight is the primary consideration, since many tools must be handled manually, often by women workers. With magnesium tooling plate it is possible to build tools that are light and yet have the required rigidity.

A leading manufacturer of fractional horsepower electric motors converted to magnesium for the stators and end frames of three models and installed magnesium die casting facilities in its own plant. The end frames of these motors are die cast by the new magnesium hot chamber process, which produces castings with good surface finish and intricate design at high production rates. For many parts it is price competitive with the zinc hot chamber and the aluminum cold chamber methods.

Development of the Dow magnesium hot chamber machine has resulted in increased interest in the use of magnesium by the automotive industry. Magnesium die castings are found in such parts as steering column shrouds, steering column brackets and caps, steering column collars, fan spacers, oil seals, window bracket assemblies, power steering unit reservoir covers, signal switch housings and fuel pump housings. A leading auto parts manufacturer has installed a magnesium hot chamber machine.

It is interesting to note that the world's largest single user of magnesium in 1955 was an automotive concern—the Volkswagenwerk in Germany, makers of the Volkswagen car. The engine of this vehicle contains 36 lb of magnesium. Most of the magnesium parts are die cast, including the transmission housing.

In 1955, a very successful consumer item requiring durability and lightness was introduced by one of the nation's leading luggage manufacturers. This item, a very attractive suitcase, is made of magnesium sheet to which colorful vinyl sheeting is bonded. These suitcases have already become the second largest selling line of luggage in the country. The vinyl bonding process is expected to lead to other consumer applications of magnesium.

Dow Etch Process of photoengraving magnesium printing plates continued its rapid growth rate. For the second consecutive year, sales of magnesium photoengraving sheet were practically doubled. As of January 1, 1956, there were 108 licensees using this process. These comprised 27 newspapers and 70 commercial engraving shops in the United States and Canada and one newspaper and 10 commercial engravers in Europe.

In forging applications, magnesium also recorded a marked increase in 1955. Helicopter rotor hub plates and aircraft landing wheels and brake parts were the chief uses.

Magnesium base-thorium-zirconium alloy was used increasingly by aircraft manufacturers in the form of sheet and sand castings. This alloy, which maintains good mechanical properties in the 400 to 700 deg F range, shows possibilities in supersonic aircraft and missiles. There is considerable interest in the aircraft field in thinner-walled castings. The commonplace minimum thickness, which used to be $\frac{3}{16}$-in., has been reduced to $\frac{1}{8}$-in., and castings with $\frac{1}{10}$-in. walls are now becoming more and more practical.

In the cathodic protection field, a new high potential anode with greater voltage output was introduced, making possible a reduction in the number of installations required to protect underground steel structures against corrosion. Also introduced was a new type anode for the sacrificial protection of steel ship hulls. This anode is coated with a tough plastic that can be cut away to expose controlled amounts of anode surface. Controlled exposure prevents overprotection of the area surrounding the anode and thus provides better current distribution.

Outlook. Research and development personnel throughout the industry are alert for opportunities to put magnesium into applications where its light weight, favorable strength-to-weight ratio and good workability can be exploited. The fact that magnesium has now attained the status of a civilian metal will undoubtedly be a factor in its increased acceptance. The outlook for 1956 is for still heavier consumption of magnesium•

TITANIUM

Thomas W. Lippert
Titanium Metals Corp. of America

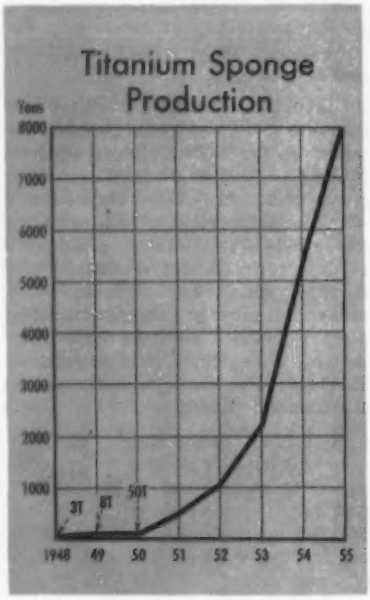
AFTER MOVING SIDEWISE in 1954, the titanium metal industry in 1955 overcame technical difficulties and again spurted forward on a steeply rising trend line which is confidently expected to continue through 1956 and 1957. Dollar value of mill products is estimated at $60-million for 1955, with sales of sponge metal accounting for an additional $30-million.

Production of mill shapes—bar, billet, sheet, strip, wire and extrusions—is estimated at 1,900 tons for 1955, some 46 per cent above the 1954 record of 1,300 tons. The 1955 mill output was divided about 54 per cent sheet and strip and 46 per cent bar, billet and extrusions.

The 1955 industry production of titanium sponge, the pure intermediate metal from which mill products are made, is estimated at 8,000 tons, up almost 50% from the 5,370-ton level of 1954, and almost four times greater than the 2,240 tons of 1953.

Three quarters of 1953, General Services Administration, at the direction of the Office of Defense Mobilization, continued its purchases of sponge in excess of mill-product requirements. Total accumulations for this temporary sponge reserve available for resale, amounted to about 6,300 tons by October 1955 against a total of about 2,890 tons reported at the end of 1954. In view of the rapidly increasing demands for mill products evidenced by early fourth quarter of 1955, Government ceased all purchases for its sponge inventory, and the year ended with sponge output and demand for mill products in relatively reasonable balance.

During the year, Titanium Metals Corp. of America (TMCA) operated its sponge plant at Henderson, Nev., at full 3,600-ton yearly capacity. DuPont is reported to have operated its 3,600-ton plant at near capacity, and initial pilot deliveries were reported from the 7,500-ton Electro-Metallurgical Co. plant (Ashtabula, Ohio), the 1,800-ton plant of Dow Chemical Co. (Midland, Mich.) and the 6,000-ton Cramet, Inc., plant (Chattanooga, Tenn.). The last three plants are scheduled to come into full production at various times late in 1956.



Foreign Production. The Japanese busily expanded their titanium sponge activities in 1955, exporting the major portion of their output to the U. S. for sale at market price. Total Japanese sponge imports for the year are estimated at 500 tons, as compared with 225 tons in 1954. The Japanese industry enjoyed a tremendous impetus late in the year, when the Commodity Credit Corp. traded various surplus farm products for 2,000 tons of Japanese sponge, to be delivered over 24 months, at a price equivalent of $3.50 per lb, as against an American sponge price at present of $3.45. This commitment will require a sizeable plant expansion in Japan.

Great Britain's sole sponge producer, Imperial Chemical Industries, achieved virtual capacity operation of 1,500 tons yearly by late 1955, and this output was absorbed by rapidly expanding aircraft requirements there.

Even more significant was the semi-official report, late in 1955, that the Russians were designing sizeable quantities of titanium into their advanced military aircraft.

Price. All through 1955, output and constantly improving production know-how exerted classic influence on price structures. On April 1, TMCA cut 55c off the $4.50 sponge price, and lowered mill products from $1.00 @ $3.00 per lb. On Nov. 1, DuPont announced a 20c per lb additional sponge reduction, and three weeks later (Nov. 23), TMCA cut the sponge selling price an additional 30c per lb (to $3.45 per lb) and again reduced various mill products from 80c @ $3.50 per lb. Therefore, 1955 saw sponge decline about 23 per cent and finished mill products an average of about 19 per cent. Such dramatic changes in just twelve months point up industry conviction that titanium is well on its way to a competitive price relationship with the other three (steel, aluminum and magnesium) structural metals.

Technology. Not only was 1955 a significant and encouraging year for titanium in the market place, but equally dramatic accomplishments were being scored on the technical front, particularly as regards sponge quality and the development of sound metallurgy for mill products. Whereas sponge quality was a subject of constant scrutiny in 1954, there was so much improvement in 1955 that the subject lost interest. As to basic alloy metallurgy, the industry accommodated itself to customer specifications on uniformity of chemical and physical properties in general more stringent than apply to the much more mature structural metals.

Outlook. For 1956, dollar value of mill products will likely exceed $120-million as compared with 1955's $60-million. Sponge may account for more than $40-million; it was $30-million in 1955.

Current Government estimates show probable 1956 requirements for mill products ranging from 4,000 tons to 4,500 tons, thereby indicating that fabricators will be under extreme pressure to more than double their record 1955 activity. The four fabricators have been expanding mill facilities in preparation for the rush of high-priority demands, and no significant delivery lags are anticipated.

The titanium industry is on the threshold of truly outstanding advancement into heat-treatable alloys, having spectacular strengths per unit of weight. Such alloys will be readily formed in a soft condition, and then heat-treated to give the reliable and very high-strength parts being designed into all advanced military aircraft•

Ferroalloys

Hubert W. Davis Ni, Co
Acting Chief, Branch of Ferrous Metals
U. S. Bureau of Mines

Gilbert L. DeHuff Jr. Mn
Commodity-Industry Analyst
U. S. Bureau of Mines

Wilmer McInnis Mo, Cr
Commodity Specialist
U. S. Bureau of Mines

R. W. Holliday W
Commodity-Industry Analyst
U. S. Bureau of Mines

RECORD PRODUCTION of steel in 1955 was accompanied by an upsurge in demand for ferroalloying metals, output of which probably equalled the all-time high set in 1953.

Imports also shared the increased demand. During the first 9 months of 1955 receipts of ferrochrome were 19,790 short tons, up 85% over the corresponding period in 1954; ferromanganese 52,098 tons (up 14%); ferrosilicon 19,909 tons (up 75%); and ferrotungsten 323 tons (up 20%).

Although comparatively small, exports of ferrochrome, ferromanganese and ferromolybdenum during the first 9 months of 1955 were greater than in the corresponding period of 1954. Exports of ferrochrome were 3,032 short tons (up 101%); ferromanganese 1,260 tons (up 21%); and ferromolybdenum 128 tons (up 156%). Exports of ferrosilicon were 1,289 tons (down 8%) and ferrotungsten 1 ton (down 77%).

Reflecting higher costs, chiefly for labor and raw materials, prices of ferromanganese, ferrotungsten, ferromolybdenum, ferrovanadium, ferrosilicon and ferrochromium advanced. Prices of ferromolybdenum, nickel and cobalt remained unchanged.

With the steel industry optimistic about a high rate of operation in 1956, demand for ferroalloys should continue high.

Hubert W. Davis

Ferroalloys Produced and Shipped From Furnaces in the U. S.

(Short tons)

	1954		1955 estimated	
	Production	Shipments	Production	Shipments
Ferromanganese	718,721	707,415	875,000	875,000
Spiegeleisen, Silicomanganese, Manganese briquets	138,469	138,277	175,000	175,000
Chromium alloys	181,673	187,780	384,000	377,000
Silicon alloys	649,950	595,387	811,000	874,000
Ferrotungsten, Ferromolybdenum, Other molybdenum products	18,375	18,890	34,000	34,000
Other ferroalloys	97,410	59,556	100,000	70,000
Total	1,804,598	1,707,305	2,379,000	2,405,000

NICKEL

Hubert W. Davis
U. S. Bureau of Mines

FREE WORLD PRODUCTION of nickel continued its uptrend for the fifth consecutive year and was probably about 212,000 short tons in 1955, a gain of 8% over 1954. Despite increased production and diversion to industry of nearly 24-million lb from scheduled shipments to the National Strategic Stockpile, the shortage of nickel for civilian needs continued in 1955.

Production. Canadian output during the first 9 months was 132,413 short tons (up 12%), and exports were 132,468 tons (up 12% also). Output of nickel oxide in Cuba was 13,900 (nickel content) in the first 11 months of 1955 (up 4%).

Imports of nickel into the United States increased for the sixth consecutive year; they were 10% more in the first 10 months of 1955 than in the corresponding period of 1954. Receipts from Canada, France and Norway were greater by 11%, 39% and 12%, but those from Cuba were 3% smaller. Imports from Japan were only 66,000 lb compared with 491,000 lb in 1954.

Consumption in the U. S. is estimated at 160,000 short tons in 1955, or 12% more than in 1954. Quantitywise, gains were most pronounced for stainless steels and engineering alloy steels, but more nickel was also used in cast irons, high-temperature and electrical-resistance alloys, electroplating, ceramics and magnets. Usage for catalysts was at about the same rate as in 1954.

Producers. Output by International Nickel Co. of Canada, Ltd., established a new record in 1955. In addition to its own ore, Inco refined some concentrates produced by Sherritt Gordon Mines, Ltd. Some of the concentrates were purchased, and some were refined under GSA contract.

International Nickel started trial operation at the first unit of its iron ore recovery plan near Copper Cliff, Ontario, in November, and the plant was scheduled soon to go into commercial production. The plant employs an Inco-developed process for recovery of nickel and iron ore from nickeliferous pyrrhotite. This first unit will treat 1,000 tons of pyrrhotite concentrate daily.

Nickel Statistics
(Short tons)

	1954	1955 estimated
United States:		
Imports	131,784	142,000
Consumption	94,733	106,000
Canada:		
Production	161,279	175,000
Exports	157,233	174,000
Cuba:		
Production	14,543	15,000
Price per lb*	60-64½c	64½c

*Electrolytic nickel in carlots at Port Colborne, Ontario, including duty of 1¼c

Output of refined nickel by Falconbridge Nickel Mines, Ltd., also was at a new high in 1955. Much of the construction work on surface plants was completed, except the railroad, mining plant and mill at Fecunis and increased smelting facilities at Falconbridge. Shaft sinking at Fecunis continued to make good progress. The Longvack and Boundary mines continued development. The new mill at the Hardy mine reached full-scale operation and was producing a very satisfactory concentrate. The pyrrhotite pilot plant was operated with encouraging results. Steady progress was being made toward completion of the expansion program at the refinery in Norway, designed to raise nickel production to 55-million lb annually. A Cottrell dust collector was completed at Falconbridge. Regular production operations were carried on at the Falconbridge, East Mine, Mount Nickel, McKim and Hardy properties.

Production of nickel at the refinery of Sherritt Gordon Mines, Ltd., at Fort Saskatchewan, Alberta, was lower than had been anticipated in the first quarter of 1955, due chiefly to trouble encountered with two thickeners which had to be rebuilt. Shutdowns while they were out of service resulted in loss of production. Subsequently operation continued to improve, and during the latter half of July and the first half of August nickel production was increased to a level above a rate of 20-million lb annually. This capacity operation, however, revealed some further bottlenecks and deficiencies that will have to be corrected to insure efficient and continuous operation at the desired rate of 20-million lb annually. At its mine and mill at Lynn Lake, Manitoba, operation has shown steady improvement and production of nickel in concentrate was maintained at a rate of 2-million lb monthly. Shipments of nickel concentrate to International Nickel continued. During the first quarter of 1955 search for new ore was resumed; two new orebodies were located, one of which appears to be higher and the other lower grade than the average (1.223%) of the reserve.

Output by Nickel Processing Corp. at the U. S. Government-owned nickel plant in Cuba established a new record in 1955, was about 3% greater than in 1954, and was only slightly less than rated capacity. The record production was achieved despite the handicap of an expansion program underway to increase capacity by 75%. Target date for completing the expansion program is October 1956. Since March 1955, output has been at an annual rate of 31-million lb.

Freeport Sulphur Co. completed its pilot plant near New Orleans, La., late in 1955. The plant will be used to test a new process for producing nickel and cobalt from deposits at Moa Bay, Cuba. Test work was begun on a 10,000-ton shipment of ore. Upon successful completion of the pilot-plant program, the company plans to build a commercial plant with an annual capacity of 30-million lb of nickel and 3-million lb of cobalt.

Hanna Nickel Smelting Co., which began construction of mine and plant facilities near Riddle, Ore., in mid-1952, started its first smelting furnace in July 1954; it was operated intermittently on an experimental basis during the remainder of that year. The second furnace and auxiliary facilities necessary for continuous operation with two furnaces were made available in January 1955. Since that time and through October 31, production was 13,109,164 lb of ferronickel averaging 42.43% nickel and containing 5,561,722 lb. The ultimate production goal (625,000 lb of contained nickel per month for two furnaces) was gradually met and exceeded, smelter production for the 3 months August-October being well above the goal. In October nearly 800,000 lb of contained nickel was produced. Construction of two additional furnaces and

related equipment was begun in 1955; they were expected to be in operation about Feb. 1, 1956. Ultimate annual capacity of the plant will be at least 7,500 tons of nickel contained in ferronickel. About 784,000 tons of ore will be required annually; it is mined at Nickel Mountain above the smelter and transported to the plant by aerial tramway.

Outlook. Free World production of nickel probably will be about 220,000 short tons in 1956, up 4% over 1955. Industrial demand for nickel in 1956 probably will exceed the 1955 consumption rate. This demand only can be met by diversion to industry of substantial quantities of nickel from scheduled shipments to the National Strategic Stockpile•

COBALT

Hubert W. Davis
U. S. Bureau of Mines

CONTINUED HIGH LEVEL of Free World production, record imports, greatly increased consumption in the United States, attainment of near-capacity production at the refinery of Calera Mining Co. and initial operation of the new cobalt-recovery unit of Sherritt Gordon Mines, Ltd., were features of the cobalt industry in 1955.

Free World production is estimated at 14,000 short tons in 1955, compared with 14,300 tons in 1954.

Imports of cobalt into the United States in the first 10 months of 1955 established a new record and were 10% more than during the corresponding period of 1954. Receipts of metal from Belgium and Belgian Congo were up 6% and from Canada 11%, but these gains were partly offset by smaller imports from West Germany, Norway and Northern Rhodesia. Imports of oxide from Belgium during the first 10 months were 2.4 times greater than in the corresponding period of 1954.

U. S. Supply. Production of cobalt metal for 10 months was 25% more than in the corresponding period of 1954. Imports increased 3%. Production of oxide was up 39%; imports up 134%. Production of salts and driers during the first 10 months is given on accompanying table.

Consumption was 8,028,000 lb during the first 10 months compared with 5,947,000 lb in the corresponding period of 1954. Cobalt-chromium-tungsten-molybdenum alloys represented 36% of cobalt consumption,

Cobalt Salts and Driers
(Co content in pounds)

	1955 10 months	Change
Production:		
Salts	336,996	+46%
Driers	483,622	+44%
Hydrate	145,411	−12%
Shipments:		
Salts	311,992	+37%
Driers	483,072	+34%
Hydrate	144,791	+16%
Imports:		
Salts and compounds	292,300	−0.4%

and the quantity used was 26% more than in 1954. Magnet alloys took 29% (up 41%).

Among the producers, Bethlehem Cornwall Corp., Calera Mining Co. and National Lead Co. produced cobalt concentrates from domestic ore. Production (cobalt content) was 2,063,000 lb in the first 10 months compared with 1,682,000 lb in the corresponding period of 1954.

Garfield (Utah) refinery of Calera Mining Co. produced 2½ times more cobalt metal in the first 10 months of 1955 than in the corresponding period of 1954. At the end of 1955 the refinery was approaching capacity production.

African Metals Corp.'s refinery at Niagara Falls, N. Y., operated at about the same rate as in 1954, and the refinery of Pyrites Co. at Wilmington, Del., at about 23% less. National Lead Co. performed tests and made development runs at its refinery at Fredericktown, Mo. Some cobalt metal was produced.

The new pilot plant and cobalt-production unit of Sherritt Gordon Mines, Ltd., at Fort Saskatchewan, Alberta, was put into operation at the end of June 1955. It will recover the cobalt contained in the nickel-copper concentrate produced by the company at Lynn Lake, Manitoba.

International Nickel Co. of Canada, Ltd., Port Colborne, Ont., produced substantially more electrolytic cobalt than in 1954. The plant of Rhokana Corp. at Nkana, Northern Rhodesia, made a record recovery of 113,098 lb of cathode metal and 57,750 lb of cobalt in carbonate in August.

Chibuluma Mines, Ltd., began producing copper-cobalt ore at its mine near Nkana, Northern Rhodesia, in October. Ore will be stockpiled until the new flotation concentrator begins operation early in 1956. The cobalt concentrate will be treated in a plant near Ndola. Production of 500,000 lb of cobalt annually is expected when full operation is attained.

Outlook. Free World production of cobalt is expected to continue high in 1956, and because of the adequate supply a further increase in consumption is anticipated•

Cobalt Statistics
(Pounds)

	Metal		Oxide (gross wt.)	
	1954	1955*	1954	1955*
U. S. production	2,870,381	2,979,053	460,045	528,599
U. S. imports	14,227,8[illegible]	12,756,799	430,400	881,650
Belgium—Belgian Congo	11,730,663	10,906,249	422,300	881,650
Canada	1,219,628	1,122,688	—	—
West Germany	918,311	495,327	8,100	1,600
Norway	322,113	230,000	—	—
Price per lb.	$2.60	$2.60	$1.96	$1.96

*10 months.

MANGANESE

Gilbert L. De Huff Jr.
U. S. Bureau of Mines

LARGELY AS A RESULT of continuation of the Government's domestic manganese purchase program, 1955 U. S. production of ore, concentrate and nodules, containing 35% or more manganese, was approximately 300,000 short tons. In addition, a like quantity of low-grade manganese ores was shipped to the Government depots at Wenden, Ariz.; Deming, N. Mex.; Butte and Philipsburg, Mont. Wenden depot closed April 29 and at Deming on or about Nov. 30; the 6-million recoverable long-ton unit quota of each having been filled.

Manganese Ore Statistics
(Short tons)

	1954	1955 estimated
Domestic production	210,000**	300,000
Domestic consumption	1,740,000	2,100,000
Exports	6,000	6,000
Imports	2,166,000	2,000,000

*Includes all ore 35% or more manganese.
**Preliminary figure.

Domestic production of ore containing 35% or more manganese, was exceeded only in the war year of 1918, when 342,000 short tons was shipped. Nodules from the Montana operations of the Anaconda Copper Mining Co. and from the Three Kids operations of Manganese, Inc., at Henderson, Nev., were equally responsible for half of the 1955 production. The "carload lot" program of General Services Administration brought out most of the remainder.

In January, Manganese Chemicals Corp. at Riverton, Minn., began shipments under contract to GSA of nodules containing 60% manganese. Trout Mining Division of American Machine & Metals, Inc. shipped battery-grade concentrates from its property at Philipsburg, Mont., and Western Electrochemical Co. continued production of synthetic battery ore at its Henderson, Nev., plant. The latter company was purchased late in the year by American Potash & Chemical Corp.

Minnesota provided over 90% of the domestic manganiferous ores used by industry, with New Mexico and Michigan supplying the larger part of the balance.

Final date for participation in the "carload lot" and Butte-Philipsburg programs of GSA was extended to June 30, 1956. Closing of the depot at Wenden saw many of its shippers turn to Deming. Due to the resulting accelerated rate of deliveries and an increase in the average grade of ores submitted, the closing at Deming came sooner than had been anticipated.

A bill, passed by the Congress but vetoed by the President in August, would have reopened the Wenden depot, established two new ones, and substantially increased existing quotas.

Imports of ore through September totaled 1,567,000 short tons, of which India was the principal supplier. Cuba, Union of South Africa and Gold Coast continued rather closely grouped, next in importance. These four countries provided two-thirds of the total U.S. imports. With the upsurge of industrial activity that featured 1955, domestic consumption of manganese ore and production of ferromanganese for the year probably rose to approximately 2,100,000 and 875,000 short tons, respectively. Industrial-ore stocks dropped a bit from the first of the year to about 1½-million short tons at the end of September. Stocks of alloy were also lower.

Prices of Indian ore (46 to 48% Mn content) recovered from 80c@82c at the beginning of the year to $1.09@$1.15 per long-ton unit of manganese, c.i.f. U. S. ports, duty extra, as quoted Dec. 8 by *E&MJ Metal and Mineral Markets*. Much of the increase was attributed to higher ocean freight rates, which are included in the price, but strengthening demand toward the end of the year was also a factor.

Long-term contracts for ore from various sources increased from a nominal price of 80@82c on the same basis to a Dec. 8 quote of 94@96c.

U. S. Government price for ores purchased under the domestic purchase programs continued to be based on $2.30 per long-ton unit for ore containing 48% manganese. Price of standard ferromanganese (74 to 76% Mn content) remained $190 per short ton until Dec. 9, when E. J. Lavino & Co. increased the price to $205.

Price increases had been announced in September for silicomanganese, medium-carbon ferromanganese, and briquets, by Vanadium Corp. of America and by Electro Metallurgical Co. In October the price of spiegeleisen was raised $2.00 per gross ton. Range is now $89.50 to $94.00.

Research. The USBM continued its extensive and diversified manganese activities, giving considerable attention to pilot-plant and laboratory research in recovery of manganese in the nation's low-grade and refractory materials. Field work was also continued.

Industry showed much interest in the high-sampling manganese-copper alloys developed by USBM at its Rolla, Mo., station in cooperation with the Navy's Bureau of Ships. These alloys combine high vibration-damping capacity with strength and other favorable properties, hence they promise to be of value where noise is a consideration. The Bureau continued research in connection with them and upon substitutes for manganese in steel production.

Industry (in large part with Government assistance) continued to work upon various processes for unlocking manganese from the nation's ultimate reserves. A $202,100, 15-month, contract was signed in September between GSA and Ores Beneficiation, Inc., for erection of a pilot plant at Joplin, Mo., and subsequent testing of a process developed by the Bruce Williams Laboratories.

Strategic Materials Corp. announced plans for pilot-plant testing in Canada of the Udy electric-furnace process for producing ferromanganese directly from low-grade manganiferous materials, such as those of its large Woodstock, New Brunswick, deposit.

Outlook. In 1956 imports of ore from Brazil should increase materially with the advent of shipments from the Amapá deposits in which Bethlehem Steel Corp. has an important interest. Domestic production of ore of 35% or more manganese content, will continue to receive the benefits of domestic purchase programs, and the tonnage produced should approximate that in 1955•

CHROMIUM

Wilmer McInnis
U. S. Bureau of Mines

UNITED STATES consumption of chromite in 1955 was an all time high. Imports increased over 1954, but domestic production was not changed significantly. Prices of some foreign ores increased, while others decreased. Industry stocks of chromite continued about the same as in 1954.

U. S. Production. Chromite output (mine shipments) during the first 9 months was 120,724 short tons, 2% higher than in 1954. The Mouat chrome mine in Montana furnished about 70% of domestic output. Concentrates that averaged 37.9% Cr_2O_3 constituted 86.7% of total shipments during the first 9 months. Average grade of all shipments was 38.9% Cr_2O_3 (wet weight).

Virtually the entire domestic output was purchased by the Government, either under individual contracts, as in the case of shipments from Montana and Alaska, or under the stimulus of the purchase program for domestic ore and concentrates. The sole purchase depot was at Grants Pass, Ore.

Consumption. Chromite consumption during the first 3 quarters set a record high of 1,119,230 short tons, up 72% over 1954. Largest increase was registered by the metallurgical industry, where 686,481 short tons was used in chromium alloys and additions to steel. Of this total 82% was metallurgical grade, 8% refractory grade and 10% chemical grade. Chrome brick, cement and other refractories used 316,377 short tons, and the remainder went into manufacture of chromium chemicals.

Stocks of chromite held by consumers at the end of September were 14% lower than at the end of 1954. Stocks held by metallurgical and chemical users decreased 19 and 17%, respectively, while refractory stocks were virtually unchanged.

Chromium Alloys. Domestic consumption of chromium alloys and metal during the first 9 months of 1955 was 221,913 short tons compared with 141,782 short tons during the same period of 1954. Average chromium content of the alloys was 60%. Stocks in the hands of consumers at the end of September totaled 27,416 short tons.

Government purchase program for domestic chrome ore and concentrates was amended on January 31, 1935, to require access to books and records related to the program by authorized representatives of the Government during the program and for 3 years thereafter. The program is for 200,000 long tons or until June 30, 1957. According to General Services Administration, 102,722 long tons had been accepted as of October 31, 1955.

Price quotations for high-carbon (4-9% C) ferrochromium (65-69% Cr) were increased by 1.5c per pound of contained chromium, and low-carbon (0.01% C) was decreased by 1.75c. Electrolytic chromium metal, commercial grade, 99% min., and the 97% grade aluminothermic chromium with 0.5% carbon was increased in September to $1.25 per pound from the former minimum of $1.16 per pound, and metal with 9-11% carbon was increased to $1.34 per pound.

U. S. imports in 1955 were about 15% higher than in 1954. High level of industrial activity and deliveries under barter agreements were responsible for the increase. During the first 9 months, imports were only slightly higher than consumption. Republic of the Philippines shipped about 30% of all imports and 81% of the refractory grade. Metallurgical-grade chromite averaged 46.8% Cr_2O_3 and comprised over half of all imports. It came chiefly from Turkey (47%), Federation of Rhodesia and Nyasaland (30%), and the Union of South Africa (12%). All chemical-grade ore came from the Union of South Africa.

World production, based on incomplete data for the first 3 quarters, appeared to be at about the same level as in 1954. Production in the Union of South Africa and the Federation of Rhodesia and Nyasaland was lower, while that in the Republic of the Philippines and Turkey was higher.

Philippines—Benguet Consolidated

Chromite Statistics

(Thousands of short tons)

	1954	1955 estimated
U. S. production (shipments)	163	165
Imports	1,470	1,700
Consumption: Total	914	1,500
Metallurgical	502	940
Refractory	278	400
Chemical	134	160

Chromite Prices in 1955

Source	Cr_2O_3 %	Cr : Fe Ratio	Price per long ton* Jan. 1	Nov. 24
Southern Rhodesia	48	3 : 1**	$43-$44	$44-$45
Southern Rhodesia	48	2.8 : 1	40-41	40-41
Southern Rhodesia	48	—	32-33	29-31
South Africa (Transvaal)	48	—	32-33	31-32
South Africa (Transvaal)	44	—	22-23	23.50-24.50
Turkey	48	3 : 1***	46-47	52-53
Turkey	46	3 : 1***	43-44	46-48
Pakistan	48	3 : 1	43-44	45-46
Domestic	48	3 : 1**	$115	$115

*Foreign operations are on a dry basis, subject to penalties if guarantees are not met, f.o.b. cars U. S. east coast ports. Rhodesian prices are on a long-term contract basis. Turkish and Pakistan prices are nominal. Domestic prices are those paid by the Government, delivered, Grants Pass, Oregon.

**Lump ore.

***Lump and concentrates.

Mining Co., operator of the Masinloc mine in the Zambales Mountains of Luzon, improved its property. Expansion of the heavy-media plant, the yard-gage railroad from mine to port and new loading facilities at the port were completed.

Acoje Chromite Mining Co. obtained a barter agreement for delivery of 70,000 tons of concentrates between August 1955 and June 1956. The company was operating on a full 6-day week, producing about 250 tons of concentrates a day.

Palawan Consolidated Mining Co., formed in July 1955 to develop both the Irahuan and Sugod Mercury deposits in Palawan, expects the property to begin shipping the metallurgical-grade ore sometime in April or May 1956.

Outlook. Domestic production of chromite in 1956 is expected to increase slightly over 1955. Consumption, following the fortunes of steel, is expected to increase. Owing to the high level of stocks in the hands of industry, imports may not increase substantially•

TUNGSTEN

R. W. Holliday
U. S. Bureau of Mines

WHILE ESTABLISHING A RECORD for domestic output of tungsten in 1955, operators were preparing for the possibility of more restrictive marketing situation in 1956.

Following Presidential veto of H. R. 6373, which would have extended the Domestic Tungsten Program, it is estimated that Government purchase of domestic concentrates will terminate in June or July 1956. Preparations varied according to purse and circumstance and included installation of more efficient machinery, advanced mine development, new processing or refining methods and search for new markets. Some companies curtailed expenditures.

Tungsten Ore and Concentrates in the U. S.

(Thousands of pounds)

	1954	1955 Estimated
Production	13,136	15,000
Consumption	4,037	8,800
General imports	22,989	20,000

Domestic Production. Mines listed on the accompanying table produced 77% of total output. The pattern of production varied in different regions. In North Carolina, where a large, well-equipped mine and mill have been producing hübnerite concentrate for several years, a chemical plant was added early in 1955 for treating scheelite and sulphide rejects. Formerly these were stockpiled or shipped elsewhere for treatment.

In Boulder County, Colo., ferberite was mined on a relatively small scale, and most recovery was obtained with jigs, although Wah Chang Corp. did some experimental flotation at its newly acquired Marion mill.

Early in the year the Strawberry tungsten mine near Yosemite National Park was purchased by New Idria Mining & Chemical Co.

In producing Nevada and California scheelite ore, flotation played an important role in beneficiation, as did acid leaching of phosphorus and calcite from the concentrates.

Ores were treated on a custom basis in nearly all mining areas, and these supplied an estimated 14% of all domestic tungsten concentrates; however, custom treating of subgrade concentrates, because of lower transportation costs per unit, tended to center in Salt Lake City, Utah (Salt Lake Tungsten Co.), Glen Cove, N. Y. (Wah Chang Corp.), and Bishop, Calif.

Consumption of tungsten concentrates during 1955 more than doubled that of the preceding year. The steel industry used an estimated 30% of the total, either as concentrates added directly to the furnace or as ferrotungsten. Greatest consumption was undoubtedly in the manufacture of carbides.

World production in 1955 was, to some degree, an index of price and markets rather than capacity to produce. This is illustrated by the contrast between record-breaking domestic production and less-than-capacity operations in Canada, Korea, Spain, Portugal and other countries.

Korean tungsten continued to be offered at auction, and it was reported that a chemical plant for producing higher grade concentrates was planned. Production from Bolivia remained about the same as in 1954. Rehabilitation of the Mawchi mine in Burma was begun, but the mine has apparently not yet become a major factor.

Price. *E&MJ* quotations for 1955 showed concentrates at $26.00 @ $28.00 at the year's beginning and $33.00@$34.50 at the year-end. Fluctuation was not extreme and, except for January and part of April, prices were above $30.00. Prices quoted are

Tungsten Producing Mines

Mine	Mineral	Company	State
Atolia	Scheelite	Surcease Mining Co.	California
Benton	Scheelite	Wah Chang Corp.	California
Climax	Hübnerite	Climax Molybdenum Co.	Colorado
Gabbs	Scheelite	Gabbs Exploration Co.	Nevada
Getchell Group	Scheelite	Getchell Mines, Inc.	Nevada
Hamme	Hübnerite	Tungsten Mining Corp.	North Carolina
Ima	Hübnerite	Bradley Mining Co.	Idaho
Ivanhoe	Scheelite	Minerals Engineering Co.	Montana
Leonard	Scheelite	Nevada Scheelite Div. of Kennametal	Nevada
Lincoln	Scheelite	Wah Chang Corp.	Nevada
Pine Creek	Scheelite	Union Carbide Nuclear Co.	California
Various underground mines and open pits	Scheelite	Nevada Massachusetts Co.	Nevada

per short ton unit of WO_3, concentrates of known good analyses, basis 65%, nearby arrival, c.i.f. U. S. ports, duty extra.

London prices were 196@200 shillings per long-ton unit c.i.f. Europe at the beginning and 267@271 at the end of the year, with fluctuations roughly paralleling those in the U. S.

Domestic concentrates of standard grade were sold to General Services Administration for $63.00 per short-ton unit.

Imports of tungsten ores and concentrates into the United States during the first 9 months were 15,201,000 lb (metal content) compared to 18,612,000 lb for the same period of 1954.

Hearings were held by the United States Tariff Commission and the Committee for Reciprocity Information before negotiation of trade agreements, as authorized by H. R. 1, Trade Agreements Extension Act of 1955. Negotiations scheduled to begin early in 1956 will consider the advisability of making additional tariff concessions on tungsten ores and concentrates as well as various processed materials.

Research on tungsten recovery from western ores by the Bureau of Mines and private firms continued, with greatest emphasis on flotation and leaching techniques. However, transition from shortage of supply to excess has shifted attention toward development of new uses. (Past research on uses was conducted mainly by consumers and was often directed toward finding substitutes rather than new uses for tungsten.) A contract signed in November between the Tungsten Institute and the Stanford Research Institute provides in part for study of high-temperature alloys in jet engines.

Also important to tungsten is the vast research in nuclear energy, electronics and air travel at supersonic speed where large sums are being spent for the study of metals.

Outlook. Obviously the future scale of foreign and domestic production depends largely on purchases by the U. S. Government. If Government purchases are reduced, foreign as well as domestic suppliers will have to curtail operations to a level more nearly in balance with industrial demand.

During the first 6 months of 1956 domestic production is expected to continue at or near the 1955 rate. In the latter half of 1956 the tungsten-mining industry may be obliged to reduce output and adjust itself to a competitive status•

MOLYBDENUM

Wilmer McInnis
U. S. Bureau of Mines

UNITED STATES PRODUCTION and consumption of molybdenum in concentrates and production and shipments of molybdenum products in 1955 were the highest of any peacetime year.

Domestic production of molybdenum in concentrates during the first 10 months of 1955 was 50,945,000 lb, a rate that indicated an all-time high for the year. Virtually all output was derived from the mineral molybdenite (MoS_2), but some powellite, $Ca(Mo, W)O_4$, was recovered as a byproduct from Union Carbide Nuclear Co.'s (formerly U. S. Vanadium Co.) tungsten mining operations at Pine Creek near Bishop, Calif. During the first three quarters of the year, mines operated chiefly for molybdenum produced 71% of the total. Strikes (in July and early August) at some byproduct plants curtailed production from these sources, nevertheless output for January-September was 12% higher than during the same period of 1954. Except for production at Miami Copper Co.'s plant in Arizona, pratically all concentrates for domestic consumption were shipped to plants in Pennsylvania and Ohio for conversion to molybdenum products.

United States consumption of molybdenum in concentrates and production and shipments of molybdenum products were higher than in any year since 1943. Consumption of molybdenum in concentrates during the first 10 months was 31,748,000 lb compared with 19,576,000 lb during the same period in 1954. Production and shipments of molybdenum products in the first 10 months were 58 and 55%, respectively, greater than in the same months of 1954.

The iron and steel industry consumed about 85 to 90% of all molybdenum used in the United States in 1955. The remainder was consumed as metal and in the production of nonferrous alloys and in nonmetallic uses.

Exports of molybdenum concentrates (including roasted concentrates —during the first 10 months were 12,474,000 lb (contained molybdenum), a higher rate than in any year since 1939.

Molybdenum Prices

(Per pound of contained Mo, f.o.b. producer's plant, December 1955)

	Price
Concentrates containing 90% or more, MoS_2	$1.10
Technical grade MoO_3	$1.30-$1.33
Calcium molybdenate	$1.28
Ferromolybdenum, powdered 55-65% Mo content	$1.66
Metal Powder	$3.00
All other	$1.54

Exports of ferromolybdenum and molybdenum wire were 286,000 and 9,000 lb (gross weight), respectively, in the first three quarters of 1955. Exports of molybdenum in other forms are not reported separately.

Imports of 134,000 lb of molybdenum in concentrates during the first 9 months of 1955 were all from Canada under terms of a contract between the U. S. Government and the Molybdenite Corporation of Canada, Ltd.

Outlook for molybdenum in 1956 appears good. Both production and consumption are expected to increase. Exports are expected to increase as foreign nations expand use of molybdenum in the production of alloy iron and steels•

Molybdenum in the U. S.

(Thousands of pounds of contained Mo)

	1954	1955 estimated
Concentrates:		
Production	58,668	62,300
Consumption	24,710	38,000
Exports*	13,547	14,200
Primary products**		
Production	24,328	37,000
Shipments: Total	25,357	36,800
Domestic	23,717	34,300
Export	1,640	2,500

*Includes roasted concentrates.

**Comprises ferromolybdenum, molybdic oxide, and molybdenum salts and metal.

Minor Metals

Paul F. Yopes
Assistant to the Chief
Division of Minerals
U. S. Bureau of Mines

Abbott Renick **Bi,Sb,As**
Commodity-Industry Analyst
U. S. Bureau of Mines

H. T. Reno **Zr,Ta,Cb,Be**
Commodity-Industry Analyst
U. S. Bureau of Mines

Ottey M. Bishop **Cd**
Commodity-Industry Analyst
U. S. Bureau of Mines

RAPIDLY EXPANDING technological developments in nucleonics and electronics contributed to minor metals' increase in importance in 1955. Recovery of metal in pure form and easier determination of true properties were benefits gained during the year. Demand for selenium exceeded supply; zirconium output by private producers expanded enough to permit the USBM to close its facilities; demand for cesium and rubidium rose, but prices held.

Estimated production of germanium was 15,000 lb, with price unchanged at $295 per lb. Silicone found a use in solar generators (*E&MJ*, October 1955, p. 120).

Indium found greater application as an alloy material; with germanium in transistors and for other purposes. Supply was adequate at the $2.25 per troy oz price, unchanged since 1946. Production in 1955 is estimated at 15 tons. Efforts continued to find applications for tellurium, available in larger quantities as a by-product of copper production. Output for the year was about 60 tons. Hafnium, used for control rods in atomic reactors, was produced in some quantity as a by-product of pure zirconium. A few hundred lb of gallium were recovered via the Bayer alumina process, from zinc flue dust and electrolytic residues.

Exports of beryllium metal, alloys and scrap represented five times the quantity shipped in 1954. U. S. depended largely on imports for beryllium, columbium, and tantalum.

Paul F. Yopes

Joseph C. Arundale **Li**
Assistant Chief, Branch of
Const. and Chem. Materials
U. S. Bureau of Mines

James W. Pennington **Hg**
Commodity-Industry Analyst
U. S. Bureau of Mines

James E. Bell **Pt**
Commodity-Industry Analyst
U. S. Bureau of Mines

F. D. Lamb **Rare Earths**
Assistant Chief, Branch of
Rare and Precious Metals
U. S. Bureau of Mines

Fred P. Giese **Se**
Commodity-Industry Analyst
U. S. Bureau of Mines

John E. Crawford **Th**
Commodity-Industry Analyst
U. S. Bureau of Mines

ZIRCONIUM

Horace T. Reno
U. S. Bureau of Mines

ZIRCONIUM-SPONGE production decreased about 39% from 1954 even though private industry made more sponge than ever. Principal cause of the drop was the Government's departure from the zirconium producing business in May.

USBM'S zirconium plant at Northwest Electrodevelopment Laboratory, Albany, Ore., was shut down after AEC decided that accumulated stocks and current industry production could temporarily supply its needs. Part of the Bureau's production facilities were converted to research and the rest put on stand-by for resumption on 60 days' notice if necessary. Reactivation of the plant seems unlikely, however, since AEC announced tentative plans to solicit proposals from private industry for delivery of 2-million lb zirconium over a 5-year period or 1.2-million lb over a 3-year period. This quantity, in addition to 200,000 lb annually which is presently contracted for, will supply only Government needs. Zirconium for privately-financed nuclear power plants and other industrial uses will not be furnished by the Commission.

Importance of pure zirconium in nuclear power plants has grown from 1945, when it was regarded as an expensive laboratory curiosity, first produced by the Kroll magnesium-reduction process. It is highly resistant to strong alkaline solutions and fused caustic; remarkably resistant to high concentrations of most mineral acids; and, among the metallic elements with melting points above 500 deg C, only beryllium and magnesium have lower thermal neutron cross-sections. When free of impurities, it is ductile and malleable and easily formed with standard machine tools.

Quoted price of the metal has progressively decreased from $316 per lb in 1945 to $14 in 1955. Low cost and above characteristics make zirconium probably the best material so far developed for cladding and structural material in nuclear power plants.

According to reports, the fuel elements for the first full-sale electric power generating plant utilizing atomic energy, at Shippingport, Pa., will be zirconium clad plates of uranium isotope U_{235} surrounded by a 12-ton blanket of natural uranium U_{238} in zirconium-alloy tubing.

Outlook for zirconium is good. Quantity production by private industry will lower costs, even with presently known extraction methods; and, judging by the number of investigators working on the problem, new and cheaper methods will be developed. Undoubtedly zirconium will be one of the principal metals of the "atomic age" and will probably find wider use in the chemical industry as well•

COLUMBIUM-TANTALUM

Horace T. Reno
U. S. Bureau of Mines

TERMINATION of the U. S. Government purchase program for columbium-tantalum minerals disrupted the market in 1955, and prices of concentrates dropped from an average of $3.40 per unit of contained columbium plus tantalum pentoxides to a nominal price of $1.75@$2.00. Only Government forward purchase contracts, plus producers holding large stocks, prevented complete collapse of the market.

World production of columbium mineral concentrates rose more than 50% and production of tantalum mineral concentrates increased more than 100% above quantities produced in 1954. Domestic production, for the first time in history, was significant compared with consumption.

The large increase in world production of columbium and tantalum minerals in 1955 was caused principally by the purchasing program, initiated Aug. 1, 1952. Under the program, Government agreed to buy concentrates from any source at a set price averaging $1.70 per lb of contained pentoxide and to pay a 100% bonus to the actual producer until Dec. 31, 1956 or until 15-million lb had been purchased. Compared with 1954, production in Nigeria and Belgian Congo, the principal producing nations, more than doubled and production of tantalum minerals in Nigeria more than quadrupled.

Purchase program ended in May, when receipts and forward commitments filled the quota. Forward commitments were for 3 and 6 months, however, and many of the principal mines continued a high rate of production to meet delivery dates.

World price was immediately affected by the stoppage. No price was quoted for columbite from May to August, and then it was nominal at $2.25@$2.50 per lb of contained pentoxides. During the week of Sept. 22 it lowered to $2.00@$2.25, the following week to $1.75@$2.00 and the week of Dec. 8 to $1.35@$1.65, where it remained for the rest of the year.

Domestic production increased greatly when one dredge began mining a euxenite-bearing placer in Bear Valley, Idaho. Another dredge was moved to the site from Helena, Mont., but did not operate in 1955. When both are operating at capacity, approximately 1-million lb of concentrate will be produced annually from the Valley County deposit. Operation, which will sell concentrates to the Government under a special contract not under the 15-million lb quota, is the only one known in the world where columbium and tantalum are obtained from euxenite.

Research to develop better high-temperature alloys, using columbium and tantalum, was spurred by development of ample reserves and large supplies. Atomic Energy Commission began a comprehensive investigation of high-temperature mechanical characteristics and corrosion behavior of pure col-

umbium and many of its alloys and the Department of Defense, although continuing restrictions on use of columbium in military aircraft, actively encouraged high-temperature studies.

GSA financed a USBM research project on the metals from October 1952 to September 1955, and the Bureau continued the project on a smaller scale from late September. Most of the work was at Rolla, Mo., laboratories to develop methods for treating low-grade columbium-bearing titanium ores of Arkansas.

Principal problem is to devise a satisfactory method of extracting the metals in a saleable form and separately. A chlorination, fractional distillation process currently being studied is promising in that it yields an almost pure columbium oxide, but recovery is low and costs are still too high to make the deposits economical. A liquid-liquid process for separating columbium and tantalum was developed at the USBM Electrodevelopment Laboratories at Albany, Ore., in 1953 and 1954, and in 1955 the work was directed toward applying the separation process to low-grade concentrates and reducing the cost of dissolving columbium-tantalum minerals.

Private industry research concentrated on methods to exploit pyrochlore-type deposits. These deposits, though low-grade (0.2 to 0.7% Cb_2O_5) are large and contain many thousands of tons of columbium. Pyrochlore deposits were explored successfully in Canada (at Oka, Que.; Numegos and Lake Nipissing, Ont.), and in Africa (in Nigeria, Kenya and Uganda). The Canadian deposits, if exploited, will end U. S. dependence on seaborne imports of columbium. Interest in them survived the purchase program termination.

Outlook. Mine production of columbium and tantalum minerals will apparently decrease greatly from 1955's quantity unless current research develops economical methods to treat the pyrochlores, or prices equal those paid under the defunct program.

Tantalum consumption will probably increase, following about the same pattern it has in the past, although new developments in tantalum capacitors may accelerate the trend. Quantity of columbium consumed by private industry should increase to about that consumed before the Korean War, not considering consumption for new uses. Current research work could result in a demand far in excess of the 1955 supply•

PLATINUM

James E. Bell
U. S. Bureau of Mines

UNITED STATES is the leading user of platinum-group metals and consumes more than half the world's output. Major source for U. S. consumers is in foreign countries, with the remainder coming from domestic secondary sources and crude platinum produced in Alaska. Last year was characterized by large production, strong demand and decline and recovery of the price. Considerable platinum and palladium of Soviet origin appeared.

Platinum found a new use as catalyst for producing high-octane gasoline from low-grade and natural gasoline which appeared to be a major market. Demand for platinum for jewelry was well below the level of the late 1940's.

Production figures for 1955 are estimated as follows: Union of South Africa, 360,000 oz troy; Canada, 330,000; Soviet Union, 100,000; United States, 25,000; Colombia, 25,000; total world production 840,000 oz troy. Breakdown of that total should be about 510,000 oz troy of platinum; 250,000 palladium; 80,000 iridium, osmium, rhodium and ruthenium.

Platinum-Group Statistics

(Thousands of troy ounces)

	1954 9 months	1955 9 months
PLATINUM-GROUP		
Imports	416.5	771.6
Domestic refined	72.7	73.4
Domestic consumption	385.0	616.4
PLATINUM		
Domestic sales and exports	216.1	348.5
Imports and domestic ref.	265.3	397.4
PALLADIUM		
Domestic sales and exports	116.5	264.8
Imports and domestic ref.	165.9	398.7
IRIDIUM, OSMIUM, RHODIUM, RUTHENIUM		
Domestic sales and exports	20.0	23.1
Imports and domestic ref.	20.5	18.7

Of domestic platinum consumption (247,300 oz troy), 76% was used for chemical purposes; 11% electrical; 2% dental and musical; 10% jewelry and decorative and 1% miscellaneous. Retail price for platinum declined from $84 per oz troy to $79 during the first half of the year and then rose steadily, reaching $117 in December.

Domestic palladium sales plus exports were 188,000 oz, distributed through the first six months as follows: chemical 10%; electrical 73%; dental and medical 8%; jewelry and decorative 7% and miscellaneous 2%. Retail price declined from $21 per oz troy during the early part of the year and then recovered to $24. Platinum and palladium for Government stockpile were acquired by barter for foodstuffs with friendly countries by the Commodity Credit Corp. of the Department of Agriculture.

Refined iridium, osmium, rhodium and ruthenium were used principally by the chemical industry (48%). Retail prices were, respectively, $100@$135, $100@$140, $125, and $55@$65.

Imports of the four metals rose by more than 6,000 oz troy during the third quarter (see table). At the six months mark, imports were 12,400 oz. Domestic consumption as measured by sales plus exports were 15,700 oz.

Outlook for the platinum-group metals for 1956 indicates a world production rate about the same as last year's and continued strong demand for all uses, particularly for catalytic plants in oil refineries•

ANTIMONY

Abbott Renick
U. S. Bureau of Mines

SUPPLY OF PRIMARY ANTIMONY in 1955 appeared more than adequate for domestic requirements. Domestic mine production (650 tons) and antimony recovered from foreign and domestic silver-lead ores (1,700 tons) were down from 1954 output, but total imports rose some 37%.

Antimony Statistics
(Short tons)

	1954	1955 estimated
Domestic mine production	770	650
General imports	8,700	11,900
Exports	45	50
Consumption of primary antimony	12,000	11,500
Average price of antimony metal, RMM brand, in bulk, 99½%, f.o.b. Laredo, cents per lb	28.50	30.19

Of the estimated 11,900 short tons imported in 1955, 7,500 were in ore and concentrates, 3,100 as metal and 1,300 in oxide. Comparable receipts in 1954 were 4,700, 2,800, and 1,200 tons respectively. Based on data for the first nine months of 1955, Mexico, Union of South Africa and Bolivia supplied 88% of ore and concentrates; Mexico and Belgium - Luxembourg 58% of metal; United Kingdom 85% of the oxide.

Exports of ore, metal and alloys continued negligible in 1955. Exports of antimony salts and compounds through September were 150 tons.

Smelter production in the U.S. was approximately 8,000 tons, a slight gain over 1954's 7,900 mark. Of the total, some 63% was in oxide form. Recovery of secondary antimony for last year was expected to remain at 22,000 short tons.

According to data through September, consumption of primary antimony was expected to drop 4% from the 12,000 tons consumed in the previous year. Nonmetal products required about 60% of the total and metal products the remainder.

Price of domestic antimony metal, RMM brand f.o.b. Laredo, in carload lots, averaged 30.19c per lb in 1955 and ranged from a low of 28.50c at the beginning of the year to a high of 33c at year-end. Average N.Y. price for metal, RMM brand, in cases was 32.16c per lb, compared with the 1954 average of 30.47c. N.Y. price for foreign metal prevailing on Dec. 10 (duty paid in lots of 5 tons or more) was as follows:

99.6%	28@28.50c
99.5%	27@28c
99%	26@27c

Demand for antimony in the form of Bolivian chemical-grade ore was firm in 1955. According to *E&MJ Metal and Mineral Markets*, price for minimum 65% ore increased from $4.00@$4.20 on Jan. 1, 1955 to $4.50@$4.60 in April. Quoted prices in late November were $4.05@$4.25. According to the same source, the N. Y. price of antimony oxide, quoted in cents per pound, was as follows:

	carlots, in bags	less than carlots, bags
Jan. 1	29.00	30.50
May 17	27.00	28.50
Oct. 20	29.00	30.50
Nov. 30	29.00	30.50

CADMIUM

O. M. Bishop
U. S. Bureau of Mines

RECORD HIGHS were set by cadmium consumption, imports, exports and production in 1955. Total supply, consisting of metal production at domestic plants and imports, approximated 11, 650, 000 lb, or 17% more than 1954.

Apparent consumption of primary cadmium increased to 11,160,000 lb, a mark which exceeded the 7.5-million lb figure of 1954 by 48% and the previous 1953 record (9,627,000 lb) by 16%. Metal producers' shipments, including internal consumption, increased 32% to about 10.5-million.

Stocks of metal held by producers at year-end were about 3,750,000 lb, or 17% under the end of 1954, but stocks held by manufacturers and distributors of compounds increased to about 400,000.

Total metal stocks declined from 4,825,000 lb to approximately 4,150,000 lb; a 5-months supply at the 1955 rate of consumption.

Production of primary cadmium (9,650,000 lb) exceeded 1954 output by about 2% and approximated the 1953 mark of 9,682,000 lb. Primary material upon which output was based was, as in other years, chiefly zinc and lead concentrates and cadmium-bearing materials from zinc, lead and copper reduction plants. About half of production was derived from imported lead and zinc ores and flue dusts. Mexico continued to be the major source, followed by Canada and Peru.

Imports of metal totaled 1,536,000 lb through September, compared with 402,000 lb for all of 1954. Imports of cadmium in flue dust for the first nine months totaled 1,680,000 lb against total 1954 imports of 1,078,000. Based on the first nine months, Italy apparently supplied 50% of the metal, Canada 20%, Japan 12%, Belgium-Luxembourg 11%, Netherlands 6% and Peru, 1%.

Exports to September as reported by the U. S. Department of Commerce, were 940,000 lb, an indicated annual rate of 1,250,000, or 25% greater than the previous record.

Quoted price of cadmium sticks and bars, delivered in 1- to 5-ton lots, and quoted price for special platers' shapes, was $1.70 per lb all year. Sales in larger quantities were at a discount.

Outlook for 1956 is bright as industry gives every evidence of maintaining high-level output throughout the year. Supplies are ample and price (in relation to competitive materials) should encourage growth•

SELENIUM

Fred P. Giese
U. S. Bureau of Mines

DEMAND FOR SELENIUM exceeded supply in 1955 and no alleviation of the shortage was foreseen for 1956. Principal source was the anode slimes produced during the electrolytic refining of blister copper. Production of selenium from its ores or other primary sources was almost non-existent.

Major producers were American Smelting & Refining Co., American Metals Co., Kennecott Copper Corp., International Smelting & Refining Co. and Kawecki Chemical Co. In addition to its other selenium operations, Kawecki began recovering selenium from lead smelter flue dusts during the year. Labor difficulties in the domestic copper industry were all settled by mid-September, but it was estimated that selenium production for the year was reduced by some 80,000 lb by strikes.

Export quotas for the year were continued at 24,000 lb selenium. Minor additions were made in 1955 to the National Strategic Stockpile holdings of selenium.

Selenium Statistics
(Pounds)

	1954	1955 estimated
Production	839,776	825,000
Imports	194,692	175,000
Total	1,034,468	1,000,000

Imports during the year were principally from Canada; approximating the level of 1954. Major Canadian producers were Canadian Copper Refiners, Ltd. and International Nickel Co. of Canada, Ltd. Consumer prices of commercial-grade selenium rose from $6.00 to $7.25 per lb, effective Jan. 3, 1955, and advanced again to $10.50 per lb Aug. 8. Some consumers reported paying $13 and higher during the last quarter.

Major consumers were rectifier manufacturers (50% of available supply) and pigment producers (25%). Other consumers included the chemical, rubber, glass and alloy-steel industries. Selenium users would probably have doubled their consumption if the metal had been available. Research on development of silicon, germanium and titanium dioxide rectifiers continued, and the new rectifiers were expected to replace selenium rectifiers for some specific uses. USBM continued its research on recovery of selenium from ores, and Battelle Memorial Institute investigated recovery of selenium from vegetation, in cooperation with GSA.

Exploration was aimed toward commercial primary sources. Bureau of Mines accelerated its exploration program in the western states, in cooperation with GSA. Results of USBM exploratory drilling of the seleniferous tuffs at Lysite, Wyo., were disappointing. Private industry was equally unsuccessful in its search for economic sources. The most promising deposits were apparently the carbonaceous shales of the Phosphoria formation extending over Idaho, Montana, Wyoming and Utah.

Outlook for selenium for 1956 indicated continued shortage of the metal, an increasing demand and possible advances in price•

LITHIUM

Joseph C. Arundale
U. S. Bureau of Mines

RECORD OUTPUT of lithium minerals and completion of several new processing facilities resulted in ample supplies of lithium products in 1955, for the first time in several years. Lithium acquired the stature of a major industry.

Domestic capacity to produce lithium was doubled in 1953, again in 1954, and additional facilities were completed in 1955, with still others under construction at year-end. Foote Mineral Co. completed a second expansion at its mine and plant at Kings Mountain and at the chemical plant at Sunbright, Va. Lithium Corp. of America started its chemical plant at Bessemer City, N. C. in operation and was expecting regular spodumene shipments from Quebec Lithium Corp. by the end of the year. Maywood Chemical Works reported a moderate increase in output and continued utilization of hand-cobbed spodumene from the famous Etta mine and some purchased and imported ore (*E&MJ*, September 1955.) American Lithium Chemicals, a subsidiary of American Potash & Chemical Corp., expected completion of its San Antonio plant early this year. Lepidolite from Southern Rhodesia is being stockpiled at the site. Firm continued production from Searles Lake, Trona, Calif.

Total imports reached a record high in 1955, as did imports of petalite and lepidolite. In the past, most of the available supplies of these minerals were consumed directly in ceramics and glass, but much of the lepidolite imported in 1955 was stockpiled for later conversion to lithium chemicals.

Reserves of lithium raw materials in North America are adequate for foreseeable needs and are being increased. According to a recent USGS survey, indicated reserves in domestic pegmatites are 5-million units of lithia (20 lb to the unit); reserves at Searles Lake are estimated at 9-million tons. Inferred reserves in the U. S. and Canada are estimated at 125-million units or more; all capable of being mined and milled essentially by present-day methods and at current costs. Future developments may make feasible the use of saline deposits, clays, sedimentary rocks and other sources.

Increased activity all over the world included areas in Southern Rhodesia, southwest Africa, Mozambique, Australia, Brazil, Belgian Congo; with

greatest interest in Canada, where a multitude of firms and individuals staked claims. One firm, Quebec Lithium, was nearing production in the Val d'Or region of Quebec, preparatory to shipping to LCA's installation. (Some 71 freight cars had been shipped by Quebec Lithium in early January.—Ed.

New technology advances included roasting of spodumene ore without concentration by froth flotation, as is done by most other producers. While not new in theory, the practice is the first on a large, commercial scale. Recovery was increased through efforts of industry and USBM. Foote Mineral attained better recovery at Kings Mountain by changes in grinding, conditioning and flotation phases of the flowsheet. Some progress was made in separation of spodumene and beryl in Kings Mountain ores and American Potash also reported profitable changes in its flowsheet at Trona.

The California firm also said that increased technical information on processing lepidolite had contributed to the feasibility of its project at San Antonio.

Dramatic increases in the uses of lithium in greases and ceramics accounted for probably two-thirds of the lithium consumed in 1955. Some of the more important uses for lithium were lithium fluoride in brazing aluminum, lithium hydroxide in the electrolyte of the cells of alkaline storage batteries, lithium bromide in air conditioning and lithium hydride in organic synthesis. Consumption for these purposes increased during 1955 and further increases are anticipated. Even more significant was the long list of potential uses for various lithium products. This list of possible new or greatly expanded usage includes enamels, glazes, cermets, bleaches, propellants, and the electrolyte of aluminum cells. Various lithium products have possible utilization as oil additives, reducing agents in production of refractory metals or organic compounds, and many other products and services.

Outlook for lithium is a combination of ample supplies, where consumers and potential consumers need not worry about supply; stepped-up research, to improve mining, processing and manufacturing methods; lower prices, through more efficient plants, improved efficiency and greater competition; and new and vastly expanded application of lithium throughout industry•

THORIUM

John E. Crawford
U. S. Bureau of Mines

SPECIAL MAGNESIUM ALLOYS may soon become a dominant consumer of thorium. Monazite continued to be the major source of thorium in 1955, with some publicity given to thorite occurrences of possible economic significance in Colorado. Nuclear engineers regarded thorium hopefully as a breeder material for producing fissionable uranium-233, but no reactors were constructed during the year to test the theory.

Thorium was recovered from monazite-containing black sands by various companies in a number of states:

Florida—Humphreys Gold Corp., Jacksonville; Florida Ore Processing Co., Sharonville; Idaho—Baumhoff-Marshall Inc., Boise; Idaho-Canadian Dredging Co., Boise; Porter Bros. Inc., Boise; South Carolina—Marine Minerals Inc., Aiken.

Outside the U. S., occurrences were reported in Australia, Brazil, Ceylon, India, Madagascar and the Union of South Africa. Countries considered potential sources are Belgian Congo, Korea, Thailand and Indonesia. One leading U. S. firm imported significant quantities of monazite from the Union of South Africa.

Producers of refined thorium products in 1955 included: Lindsay Chemical Co., West Chicago, Ill.; Rare Earths, Inc., Pompton Plains, N. J.; Maywood Chemical Works, Maywood, N. J.; Metal Hydrides, Beverly, Mass.; Norton Co., Worcester, Mass.; and Westinghouse Electric Corp.'s Lamp division, Bloomfield, N. J.

High-purity thorium-metal production techniques were studied by the Bureau of Mines on behalf of AEC. Metal Hydrides Inc., Horizons, Inc., of Princeton, N. J., and Cooper Metallurgical Associates, of Cleveland, Ohio, were reported actively engaged.

Thorium Procurement Authorizations

(Non-energy uses)
(Pounds of contained ThO_2)

	1954	1955 estimated*
Magnesium alloys	4,647	16,205
Gas mantle manufacture	9,765	39,400
Refractories and polishing compounds	24	126
Chemical and medical	3,738	3,230
Electrical	2,016	1,064
Total	20,190	60,025

*Based on figures for first 10 months.

Prices of some thorium compounds were quoted by a leading producer in 1955 for 100-lb lots or more as follows:

Th compound	Percent ThO_2	Price
Carbonate	80-85	$7.25 @ $8.80
Chloride	50	$7.00 @ $8.16*
Fluoride	80	$6.00
Nitrate	47	$3.00**
Oxide	97-99	$8.25 @ $9.35

* Depending upon rare-earth content

** Regular mantle grade

Thorium metal was available during the year at the following prices and in the following forms. Chief impurities are: calcium, about 0.05%; iron, about 0.5%; ThO_2, about 1.0 to 1.5%. Price is quoted per gram and divided into "less than 200 grams per item" and "200 grams or more per item."

	Less than 200 grams	200 grams or more
Powder	$0.45	$0.35
Unsintered bars	.50	.40
Sintered bars	.65	.50
Sheet, 0.005-in. and over	.75	.60
Sheet, 0.002-in. to 0.0049	.85	.70

AEC is responsible for the allocation of thorium to industry, inasmuch as the metal is clasified as a "source material" by the Atomic Energy Act. AEC allocations in 1954 and 1955 are shown in the accompanying table.

Magnesium-alloy producers use thorium as an additive to special magnesium alloys for certain sheet and cast products. Such alloys, containing as much as 3% Th, enjoy greater fatigue resistance at ambient and elevated temperatures than standard

magnesium and aluminum alloys. In 1955, the alloy was used in jet-engine components, probably in some guided missile parts, and in other undetermined fields.

The 303% gain in 1955 over 1954 in thorium for gas mantles may be due to greater exports of the nitrate during the year. While 126 lb thoria is estimated as having been authorized for refractories and polishing compounds in 1955, the proportion of over-all consumption represented by that category is not significant.

Chemical industry uses thorium compounds as catalyst in (1) producing ammonia from nitric acid, (2) sulphur trioxide from sulphur dioxide, (3) water gas from carbon monoxide. It is also consumed in preparing many organic reagents. Some soluble thorium salts find application in creams and lotions because of thorium's astringency and tonic properties.

Electrical equipment manufacturers incorporate thorium with tungsten to produce mechanical shock-resistant filaments, usually used in vacuum tubes because of thorium's electron emissive power. Colloidal thorium oxide serves in a "getter" compound to evacuate air from the tube and maintain the vacuum.

Nuclear energy potentialities of thorium were publicized greatly during the year. Plans for several reactors requiring thorium were described at meetings; most notable being Consolidated Edison's 236,000-kw nuclear power plant to be constructed at Indian Point, N. Y. License application which Con Edison filed with AEC stated that the reactor would require approximately 20.8 tons Th for the first year of operation and 10.3 tons for each succeeding year. Document indicated AEC as source of the material.

Other thorium breeder reactors considered included the one involved under the aqueous homogenous reactor experiment at Oak Ridge National Laboratory; a sodium-cooled, graphite-moderated breeder designed by North American Aviation; the bismuth-uranium, bismuth-thorium liquid metal design of Brookhaven National Laboratory; a pressurized, heavy water cooled and moderated reactor sponsored by Babcock & Wilcox Co.; and the Foster-Wheeler Corp.'s concept of a dual cycle aqueous homogenous reactor.

Outlook for 1956 will be influenced by growth in acceptability of thorium-bearing magnesium alloys among industries; a development which might absorb two or three times as much thorium as in 1955. Should the AEC find it feasible to allow an increase in allocations, apparent consumption of thorium should increase significantly over 1955. Gas mantle production may maintain the level implied in last year's figures, and, while still unknown, AEC requirements, if only for research, could consume sizeable quantities•

MERCURY

James W. Pennington
U. S. Bureau of Mines

DOMESTIC PRODUCTION of mercury was virtually unchanged in 1955, industrial consumption was up, and industrial stocks and imports were down. Mercury prices fell gradually and without interruption from March to mid-August but rose slightly in the latter part of the year.

Exports and re-exports were small and lower than usual. Government measures to strengthen industry were continued through DMEA assistance for exploration and GSA's guaranteed-price program.

Mine output of mercury totaled 13,630 flasks in the first nine months and represented 30% of industrial consumption for the period. With new producers scheduled to begin operation in the final quarter, total annual output should reach 18,400 flasks; hence primary production was expected to be about the same as 1954 (18,543 flasks), the highest output since 1947.

About 90% of the metal was supplied by 10 mines, with the remainder derived from 50 smaller mines. As usual, California led in production with more than 55% of the total: Nevada ranked second with 30% and Arizona, Idaho, Oregon, Texas and Alaska supplied the rest.

Mercury Statistics
(76-lb flasks)

	1954	1955
Production	18,543	18,400*
Imports (general)	65,316	11,928**
Exports	890	297**
Avg. price, N. Y.	$264.39	$290.05*

*Estimated
**Nine months

Secondary production of mercury was abnormally high, due to dismantling of a plant using mercury in early 1955. Some 8,620 flasks were reclaimed from January through September, compared with 6,100 flasks for the entire previous year. If secondary production rate of the fourth quarter equals the third, annual production should be about 9,500 flasks, more than 50% of estimated mine output and over 30% of total primary and secondary domestic production.

Imports fell sharply in the last quarter of 1954 and continued at a reduced rate in 1955; only 11,928 flasks were imported in the first three quarters, compared with 61,368 in the corresponding 1954 period. Share of U. S. imports held by Spain and Italy (79% in 1954) dropped to only 9% for those two countries combined and Mexico's share rose to 67%, with 23% more coming from Yugoslavia. In 1954, the latter two nations combined only contributed 20%. Exports and re-exports, always small, were 297 and 259 flasks respectively, for the first three quarters—less than 1954.

Industrial consumption for the first nine months was 45,700 flasks, up 44% over the like period of 1954. Nearly all the increase was made early in the year, when the mercury cells in a chlorine and caustic soda plant at Muscle Shoals, Ala., were put into operation. Mercury used in these cells is recoverable.

Other uses for the metal were principally in electronics, agriculture, and industrial and control instruments. No installations requiring large amounts were planned for the later quarters, so total consumption probably was about 54,500 flasks, an increase of 11,700 over 1954.

Muscle Shoals withdrawals also reduced consumer and dealer inventories to the lowest point since USBM began collecting such data in 1939. From January to September, stocks

declined from 22,300 to 5,500 flasks; producers' stocks increased from 186 to 1,064 flasks. Despite lower inventories, consumers and dealers seem reluctant to replenish at existing prices.

Prices moved from $322@$324 at the beginning of the year through a slight increase in March and then declined slowly to a range of $253@$255 by mid-August. A slow rise began then, reaching $280@$284 per flask in November and continuing at that general level to mid-December. No drastic change was expected by year-end.

Contributors to the strength of the price were the two Government-sponsored projects, DMEA's aid for exploration and GSA's guaranteed sale price. The latter provides for the purchase, at $225 per flask, of a maximum of 125,000 flasks domestic mercury and 75,000 flasks Mexican, scheduled to end Dec. 31, 1957. Program also provides for foreign contracts, particularly among mercury producers in Canada.

Outlook for the metal indicates that both domestic and world production will continue the upward trend of recent years. Domestic ore reserves are being increased through DMEA and private interests; new facilities are being installed and existing ones expanded in the U. S. and abroad. Consumption should increase through larger demand in current applications and development of new uses. In order to raise inventories to their normal level, a full year's production would be required•

RARE EARTHS

Frank D. Lamb
U. S. Bureau of Mines

THE FAMILY of 15 rare-earths and their closely related cousins, scandium, thorium and yttrium, were subjects of many scientific investigations during the past year. Increasing abundance of the lesser-known elements through co-product recovery with thorium from monazite increased research activity. Although industrial consumption of rare-earth metals remained largely in the fields to which they have been confined for more than a century, new applications seemed near.

The large California deposit of bastnaesite, which contains almost no thorium, was mined on a reduced scale by Molybdenum Corp. of America to furnish rare-earth compounds for study by the steel industry and others, and there seemed little doubt that, except for the value of the Th contained in monazite, bastnaesite would be a more economical source of the lighter, or "cerium group" of rare earths than any other known mineral.

Tied to monazite production as it is, rare-earths output suffered when the Idaho dredges shut down in the face of South African material. But, later in the year, Porter Bros. Corp. of Spokane and Boise started a dredge operation in Bear Valley, Valley County, Idaho, which was the first commercial attempt to produce euxenite, a mineral containing important quantities of rare earths, uranium and columbium. Rare earths contained in the deposit, unlike those in monazite, are the heavier, or "yttrium group," presently receiving so much attention.

Rare-Earth Oxides

(5-gram lots, 98–99.9% pure)

	price per gram		
Lanthanum	$0.02	@	.04
Cerium	.15	@	.20
Praseodymium	.50	@	.75
Neodymium	.11	@	.16
Samarium	.69	@	1.00
Europium	100.00	@	200.00
Gadolinium	3.00	@	6.00
Terbium	60.00	@	500.00
Dysprosium	30.00	@	50.00
Holmium	100.00	@	350.00
Erbium	20.00	@	145.00
Thulium	120.00	@	350.00
Ytterbium	10.00	@	25.00
Lutecium	100.00	@	230.00
Scandium	20.00	@	50.00
Yttrium	.55	@	2.00

More yttrium group rare-earths were expected from Marine Minerals Inc. monazite-xenotime-zircon-titanium placer near Aiken, S. C. Property appears significant in thorium production and as a small, but important source of xenotime, another yttrium group mineral.

Price of monazite, which sold for as much as $400 per ton early in 1955, was quoted in trade journals as low as $260 at year-end. Rare-earth compounds, essentially rare-earth oxides derived from bastnaesite, remained at $1.00 per lb throughout the year, and misch metal, the mixture of all the rare-earth metals derived from monazite, sold at $3.50 per lb.

Prices of ferrocerium and cerium metal (99% purity) were $8.00 and $18 per lb respectively. For the first time, each of the natural-occurring rare-earths in oxide form was available commercially in small quantities.

Principal uses of rare-earth metals were as ferrocerium for lighter flints and misch metal for metallurgical and alloying applications. In the field of light metals, use of misch metal alloyed with magnesium in castings for jet engine components was important, as were experiments in applying misch metal additions to magnesium alloys suitable for airframe structures.

In the steel industry misch metal and rare-earth oxides were used as additives to high-alloy stainless steels of the 310 and higher types; use of misch in manganese-type stainless steels found favor, but attempts to use low-cost rare-earth oxides in carbon steels did not prove economic.

Compounds and salts were used principally to make luminescent carbon arc cores and in the glass industry for coloring and de-colorizing glass, as well as to polish lenses, mirrors, etc.

Experimental applications included use of radioactivated thulium as energy source for a newly-developed X-ray camera; coatings for television tubes to give complete color spectrum; high neutron-absorption rods for controlling atomic power reactors; and new alloys for high-intensity permanent magnets in electrical fields.

Outlook. The industry appeared to be suffering from growing pains in 1955. Supply of raw materials was more than adequate for demand and marginal producers suffered from foreign competition. New uses developed, but not rapidly enough to absorb all of the surplus which resulted from increased thorium production. Greater research during the year will continue and has come none too soon•

BERYLLIUM

Horace T. Reno
U. S. Bureau of Mines

CIVILIAN CONSUMPTION of beryl in 1955 was the highest in history. Domestic production was about the same as the previous year, but preliminary figures indicated an increase of 15% in world output. Supply was more than ample, adding to an already large world inventory.

Greatest consumption was in the beryllium-copper master alloy, but new developments in the use of beryllium alloys and wider application of beryllium as an additive to light-metal alloys gained major interest. Cast beryllium-copper dies were used successfully for short production runs of steel forgings, for producing zinc die castings, and for forming and drawing both pure and alloy titanium sheet. Desired cavities were cast directly into the dies, decreasing tool costs.

Beryllium-bearing nickel-base alloys were investigated for use in fabricating aluminum and titanium extrusion dies. Though material costs were found to be higher than steel, savings in machining expense indicate that beryllium alloys might prove equal to, or better than steel.

Practice of adding small quantities of beryllium to magnesium-bearing alloys increased as more producers learned that the addition improves workability and melt characteristics, and reportedly reduces loss of magnesium during melting.

Use of beryllium to improve ductility of the aluminum bath in the hot-dip-bath method of aluminum-coating steel and ferrous base metals was investigated widely. Development of the aluminum coating process is seen as a possible large user of beryllium.

Beryl Statistics
(Short tons)

	1954	1955 estimated
World production	6,400	7,400
Domestic production (mine shipments)	669	650
United States imports	5,816	6,200
Total new supply	6,485	6,850
Consumption	1,948	4,500
Average domestic price per unit BeO	$47	$47
Average foreign price per unit BeO	$43	$37

Domestic beryl mines operating in 1954 supplied almost all the 1955 output as well. About half the beryl produced domestically was sold to GSA purchasing depots for an average price of $47 per unit of contained BeO—$10 a unit above the average world price. By Sept. 30, GSA had bought 774 short tons under the program, begun Oct. 7, 1952. If industry continues to take half of the domestically-produced beryl, the 1,500-ton quota will probably not be filled when the program expires June 30, 1957.

Free World output was greater, and from a larger number of sources, in 1955 than 1954. Brazil maintained its position as a leader, but by a much narrower margin than in the past. British Congo and British East African beryl production increased appreciably, probably because of greater activity in development of columbite-tantalite-bearing pegmatites and more widespread recognition of beryl minerals. New deposits were reported in Afghanistan and Hong Kong.

Outlook for the beryl mining and processing industries in the coming year is good. Domestic beryl miners are assured of Government support through 1956 and increasing consumption will probably keep the world price near the current level.

Demand for beryllium-bearing alloys in the civilian market apparently will continue to increase, supported by ample supply and further development of new uses•

BISMUTH

Abbott Renick
U. S. Bureau of Mines

STABILITY was the outstanding characteristic of world bismuth markets throughout 1955. Not since World War II has the New York bismuth market seen such a long period without a price change. Current price of $2.25 per lb in ton lots, established Sept. 5, 1950, has remained unchanged.

Imports of metallic bismuth were expected to be about the same as 1954; exports should show a substantial increase for the second consecutive year. Receipts through September were 472,000 lb (57% from Peru), and total imports for the year averaged some 630,000 lb.

Exports for the first nine months were 194,000 lb (53% to the Netherlands), a 41% increase from the 138,000 lb of 1954.

Consumption reflected increased demand in its 20% rise above the 1,439,000 lb consumed in 1954. Metal products took 77% of the total, with the pharmaceuticals absorbing the remainder. Last years' consumption of bismuth by metals and pharmaceuticals was 64% and 36% for the two fields.

Refinery production of metallic bismuth increased approximately 35% over 1954, but stocks held by consumers and dealers as of Dec. 31, 1955 were expected to remain fairly consistent with the 253 lb reported on hand at the beginning of the year•

Bismuth Metal
(Pounds)

	1954	1955 estimated
Consumption	1,439,000	1,730,000
Imports	644,000	630,000
Exports	138,000	258,000
Average N. Y. price per lb, ton lots	$2.25	

Non-Metallics

L. M. Williams — **Sulphur**
President
Freeport Sulphur Co.

H. F. Dengler — **Phosphate**
Export Sales Manager
International Minerals & Chemical Corp.

W. A. Rukeyser — **Asbestos**
Consulting Engineer
Quebec, P. Q.

W. S. Steele — **Vermiculite**
President
American Vermiculite Co.

O. S. North — **Perlite**
Commodity-Industry Analyst
U. S. Bureau of Mines

Reginald Rowand — **Barite**
Production Manager
Baroid Sales Div.
National Lead Co.

J. E. Holtzinger — **Fluorspar**
Commodity Specialist
U. S. Bureau of Mines

B. L. Gunsallus — **Feldspar**
Commodity-Industry Analyst
U. S. Bureau of Mines

GREATER OUTPUT and consumption in nearly all segments of the non-metallic mining industry were achieved in 1955. With many of the major minerals tied closely to either the consumption of major metals or to the still-booming building construction field, demand for increased tonnages reflected a continuing prosperity in the U. S. and an awakening consumption in Europe and the rest of the world. Foreign producers again made their presence known, perhaps even more insistently than before.

Throughout the following pages you will find full descriptions of the previous year's activity in the non-metallics field with some trenchant observations on what 1956 is likely to bring.

Milford M. Skow — **Mica**
Commodity-Industry Analyst
U. S. Bureau of Mines

R. D. Thomson — **Mica**
Commodity-Industry Analyst
U. S. Bureau of Mines

D. L. Libbey — **Potash**
Mining Engineer
U. S. Potash Co.

SULPHUR

Langbourne M. Williams
Freeport Sulphur Co.

U. S. SULPHUR INDUSTRY established a new production record in 1955 to meet increased demands from industry and agriculture.

Production from all sources was estimated, on the basis of preliminary data, at 6.9-million long tons, compared with 6,657,000 tons in 1954 and 6,243,000 tons in 1953. Slightly over four fifths of the total output was brimstone mined by the Frasch hot-water process from salt dome deposits along the Gulf Coast while the remainder was sulphur recovered from sour natural gas, petroleum refinery gases and surface deposits, the sulphur content of pyrites, and sulphur in various forms obtained from other sources.

The Frasch mines of Louisiana and Texas accounted for a large part of the production increase. Of the 13 mines in operation at year end, Texas Gulf Sulphur Co., the largest producer, had three in Texas; Freeport, four in Louisiana and one in Texas; Jefferson Lake Sulphur Co., two in Texas and one in Louisiana; and Duval Sulphur and Potash Co. and Standard Sulphur Co., one each in Texas.

One new mine was placed in operation in 1955 and one was closed. The addition was Freeport's Chacahoula mine located in Louisiana 60 miles west of New Orleans. Closed was Hoskins Mound near Freeport, Texas, which had been in operation longer than any other Frasch mine. All told, this Freeport property produced about 11-million tons between 1923 and May 1955, when operations ceased due to the exhaustion of the deposit.

Several new plants to obtain sulphur from sources other than salt dome deposits were completed during the year. The projects and their sources of sulphur are: American Sulphur & Refining Co., Sulphurdale, Utah, surface deposits; Rico Argentine Mining Co., Rico, Colo., pyrites; Jefferson Lake Sulphur Co., Manderson, Wyo., J. L. Parker Co., Penwell, Texas, and Signal Oil and Gas Co. and J. L. Parker Co., 14-Mile Field, Wyo., sour natural gas; Gulf Chemical Co., Girard Point, Pa., Sun Oil Co., Marcus Hook, Pa., and Union Oil Co., Santa Maria, Calif., refinery gases.

Sulphur Production in U. S.
(Long tons)

Form of sulphur	1954	1955 estimated
Frasch sulphur	5,515,000	5,700,000
Other elemental	403,000	440,000
Sulphur in pyrites	405,000	400,000
Sulphur in gases	334,000	360,000
	6,657,000	6,900,000

Domestic consumption of sulphur also reached a new high in 1955. Use of sulphur from all sources amounted to an estimated 5.6-million tons in 1955, or 550,000 tons more than in the previous year. Imports, mainly pyrites, rose to approximately 185,000 tons of sulphur content in 1955, an increase of about 65,000 tons.

Exports dropped slightly from the exceptionally high mark set in 1954. Preliminary figures indicate that the U. S. shipped about 1.5-million long tons of Frasch sulphur abroad compared with 1,650,000 in 1954. Canada and the United Kingdom continued as the largest customers while Australia, France and New Zealand followed in that order in tonnages taken.

Three plants were completed in England using anhydrite to make sulphuric acid. They are Solway Chemicals, Ltd., at Whitehaven; United Sulphuric Acid Corp., Widnes; and Imperial Chemical Industries, Ltd., Millingham. Combined productive capacity is reported to equal about 100,000 tons of sulphur annually. Elsewhere, projects either completed or scheduled for completion during the year included Musa Mining Co., Hokkaido, Japan, using native deposits; Nairne Pyrites Ltd., Nairne, Australia, pyrites; and Sui Gas Transmission Co., Pakistan, sour natural gas.

Two Frasch mines operated in Mexico: Mexican Gulf Sulphur Co. at San Cristobal dome and Pan American Sulphur Co. at Jaltipan. A third mining plant, that of Gulf Sulphur Corp. was nearing completion. All three mines are located in the Isthmus of Tehuantepec.

Outlook. Looking ahead, efforts to add further to sulphur productive capacity are continuing.

Plans for the development of one new salt dome deposit were announced during 1955 and exploratory drilling established the existence of a second. The first, known as Lake Pelto, is located on the Louisiana coast. Freeport is working on plans to install facilities there in the first attempt at mining a sulphur deposit entirely under water.

The second deposit, plans for the development of which have not yet been announced, is Block 18 of Humble Oil and Refining Co. The dome is some 6 miles off the Louisiana shore under 40 ft of water•

MICA

R. D. Thomson and M. L. Skow
U. S. Bureau of Mines

Government Purchases of Domestic Mica
1952-Oct. 31, 1955
(Pounds)

	Block, ruby, nonruby	Hand-cobbed, ruby, nonruby
Spruce Pine	393,268	1,675,505
Franklin	55,796	718,360
Custer, S. D.	23,187	1,154,197

IMPORTS of sheet mica in 1955 were estimated at about twice those in 1954. Demand for block and film mica in the manufacture of electronic and electrical equipment was at a higher level owing to increased production of radios, TV sets and household appliances.

About 65% of the muscovite block and film mica was for electronic uses. Consumption of mica splittings in-

creased about 31%. Manufacturers of molding plate and segment plate for electrical insulation continued to use the largest portion of the mica-splittings supply.

Sales of ground mica in 1955 barely topped 1954. Dry ground mica composed about 80% and wet ground mica 20% of the total. Dry ground mica was used mainly in the manufacture of roofing materials while wet ground was used by paint and rubber manufacturers.

Greater quantities of block mica were imported in 1955 compared with 1954, while imports of film mica declined. India and Brazil continued to supply most of the muscovite sheet-mica imports and Madagascar virtually all of the phlogopite splittings. Of the total muscovite block imports, 60% was Stained quality, and less than 10% was Good Stained or better.

Government purchases of domestically produced muscovite ruby and nonruby block, film and hand-cobbed mica by the General Services Administration continued at a high level. From mid-1952 to Oct. 31, 1955, the depots had accepted the equivalent of approximately 7,000 short tons of hand-cobbed mica (90 lb full-trimmed mica equivalent to 1 short ton of hand-cobbed mica). Purchases of block and hand-cobbed mica are shown in the accompanying table.

Changes in the purchasing procedure in February 1955 enabled producers to receive more than the former maximum prices of $600 and $540, respectively, per short ton of ruby and nonruby hand-cobbed mica through payment for the actual yield of Stained and Better mica obtained by the Government. Sale of hand-cobbed, rather than full-trimmed, mica was thus more attractive. As a result of the increased cost of the program, GSA modified the regulations in August so that the producers bore a larger portion of processing costs.

From the beginning of the exploration program in 1951 through Oct. 31, 1955, the Defense Minerals Exploration Administration executed 208 contracts for strategic mica. Of these, 175 were canceled or terminated, and 33 were still in force on October 31, 1955. The total of 170 terminated projects, which had a contract value of $976,476, received $644,616 from the Government and included 49 certified projects on which DMEA advanced $270,616.

Mica in the U.S.

(Pounds)

	1954	1955 estimated
IMPORTS:		
Block:		
India.....	783,375	1,592,448
Brazil.....	1,412,037	1,523,340
Other.....	91,839	109,152
Total...	2,287,251	3,224,940
Film:		
India.....	193,575	167,904
Other.....	570	156
Total...	194,145	168,060
Splittings:		
Muscovite.	4,436,721	9,160,200
Phlogopite.	370,507	860,520
Total...	4,807,228	10,020,720
CONSUMPTION:		
Muscovite Block and Film:		
Good Stained or Better quality....	156,854	300,000
Stained quality....	1,507,545	2,100,000
Lower than Stained quality....	1,554,758	1,600,000
Total...	3,219,157	4,000,000

In February 1955 the Office of Defense Mobilization appointed two special committees, one on expansion of procurement of foreign mica and one on mica substitutes. As a result of the findings of the Special Committee on Mica Substitutes, ODM in September authorized GSA to negotiate contracts with private industry and Government agencies on a 5-year program designed to accelerate and intensify research and development on substitutes for strategic mica.

Synthetic Mica Corp., a subsidiary of Mycalex Corp. of America, Clifton, N. J., began producing flake synthetic mica at Caldwell, N. J. in September. Present production is principally for use in glass-bonded products of Mycalex Corp., but considerable output is available to other industries. The corporation plans research to improve its synthetic mica product, to develop new uses, and to make reconstituted sheets of synthetic mica.

Hasset Mining Co. of Burnsville, N. C., began extracting mica from TVA's Davy Crockett Lake behind Nolichucky Dam in Tennessee, and International Minerals & Chemicals Corp. has begun construction of a $400,000 ground-mica plant at Greeneville, Tenn., to reclaim mica from the same source.

Petaca Mining Corp.'s new $300,000 mica-grinding plant near Santa Fe, N. M. started in mid-1955.

After commercialization of the process developed at the Bureau of Mines Electrotechnical Laboratory for synthesizing mica, research by USBM on synthetic mica focused on studies of growing larger crystals and fabricating reconstituted sheet. Synthetic mica is not yet a substitute for strategic grades and qualities of block and film natural mica•

FLUORSPAR

John E. Holtzinger
U. S. Bureau of Mines

PARALLELING, and tied to, the 1955 boom in steel, aluminum and chemicals, fluorspar consumption recovered from a major decline in 1954 and was expected to reach within 5% of the record 1953 usage (587,000 short tons). Improved demand, augmented by substantial Government purchases, was reflected in a moderate increase in domestic production and record imports.

Prices, which dropped sharply in 1954, improved little last year, and economic problems facing the domestic industry remained unsolved. Tariff controversy continued through the year. U. S. Tariff Commission completed a general investigation of the domestic fluorspar industry in June-July 1955. Commission report was confined to factual data and did not discuss modification of existing tariff rates. In August, the Senate committee which had requested the investigation

asked the Commission to undertake an "escape-clause" investigation of the domestic acid-grade fluorspar industry.

Testimony at resultant public hearings centered around the ability of domestic producers to expand reserves and capacity to fulfill growing requirements. Domestic industry spokesmen contended that reserves are now the largest in history and would be expanded further in a healthier profit climate. Importers pointed out the rising needs of industry and questioned adequacy of domestic resource bases.

Domestic industry also filed an application with ODM for relief under section 7 of the Reciprocal Trade Agreements Act of 1955, on grounds that imports were of such magnitude as to "impair national security", but no action was taken on the petition. In Congress, several bills were introduced to restrict imports to 25% of the previous year's consumption, and another bill was presented to limit National Strategic Stockpile purchases to domestic sources insofar as fluorspar is available at "prevailing market prices." No final actions were taken.

Metallurgical-grade production of domestic origin, estimated at 92,000 short tons, was more than 50% greater than 1954, but substantially below previous years. Imports of metallurgical grade also increased from 1954, exceeding domestic output by some 75%.

Although steel production was expected to reach an all-time high, fluorspar consumption at steel plants was well below 1953, the previous record year. Consumption of fluorspar per short ton of basic open-hearth steel has been dropping in recent years, decreasing from an average of 5.9 lb in 1953 to 4.9 lb per ton in 1954 and 4.5 in the first six months of 1955. Use of higher grade fluorspar and increased supplies of low-phosphorous iron ores are probably important factors in the reduction.

Acid-grade fluorspar production from domestic sources continued at a high rate and imports set a new record, exceeding domestic output by some 38%. Support for both sources came from substantial Government purchases, under "floor-type" contracts executed during the Korean War and contracts bartering agricultural commodities for fluorspar signed by the Commodity Credit Corp.

Consumption at hydrofluoric acid plants was estimated about equal to usage by the steel industry and was expected to reach a new mark of about

Fluorspar Statistics

(Short tons)

	1954	1955
U. S. Production:*		
Acid grade*	163,400	160,000
Ceramic grade	27,200	28,000
Metallurgical grade	58,400*	92,000
Total	249,000	280,000
Imports:*		
Containing more than 97% CaF_2*	205,800	220,000
Containing no more than 97% CaF_2	87,500	160,000
Total	293,300	380,000
U. S. Consumption:**		
Hydrofluoric acid	225,100	243,000
Steel	196,100	242,000
Glass and enamel	35,600	39,000
Other	23,600	26,000
Total	480,400	550,000

*Includes Government purchases.
**Exclusive of Government purchases.

243,000 tons. About 65% of consumption at hydrofluoric acid plants in 1955 was by the chemical industry, compared with 60% in 1954. Remainder (35% in 1955 and 40% in 1954) was used to make hydrofluoric acid which ultimately was used to produce synthetic cryolite or aluminum fluoride for aluminum production.

Ceramic-grade fluorspar consumption increased slightly in 1955. Domestic output was about equal to recent years and imports rose. Competition between domestic ceramic-grade and foreign acid-grade sold for ceramic purposes has increased to a considerable extent in recent years.

Government offers to purchase metallurgical-grade fluorspar for the National Strategic Stockpile, initially authorized in 1954, were renewed in 1955. No purchases were made in 1954, but several contracts were negotiated last year and some shipments made. Quantities authorized for purchase and stockpile receipts may not be revealed.

Formation of a fluorspar industry-advisory committee was announced in November. Committee will assist the Office of Minerals Mobilization (See *E&MJ*, January 1956, This Month in Mining.)

OMM members, all representatives of industry producers, were appointed by Interior Department to improve liaison between Government and industry. They "will not deal with specific recommendations," but will act as a forum on industry problems.

Largest producing state, Illinois, accounted for about 60% of total domestic output. Minerva Oil Co., operator of the Crystal and Minerva No. 1 mines and mills in Hardin County, purchased the Victory mine of Victory Fluorspar Mining Co. in late July. Victory, a large producer of metallurgical-grade spar in the past, was inactive during most of 1954. Other major producers in Illinois, Ozark-Mahoning and Alcoa, operated steadily throughout the year. In Kentucky, second largest producing state until 1953, output continued to decline. Pennsylvania Salt Manufacturing Co. was sinking a shaft at year-end. Company had been producing acid-grade flotation concentrates from its plant near Marion, Ky., using tailings as mill feed. Mill was down for the last part of the year.

Colorado continued in its new second place position, but production declined from 1954, largely because the Poncha mine and mill (Reynolds Metals Co.) had been down since November 1954. All but a few tons of Colorado production is acid-grade.

Montana and Utah production, principally metallurgical-grade spar, increased in 1955, while Nevada and New Mexico were down. Flotation plant operated by the General Chemical Division of Allied Chemical & Dye Corp. was closed down in September. This was the last major producer of fluorspar in New Mexico.

Outlook. Fluorspar consumption is closely tied to steel, aluminum and ceramics. Continued operation of the steel industry at present levels should provide a better market than that of 1954 and early 1955. Stocks at steel plants, which were reduced sharply throughout 1953 and '54, with a consequent shrinking of the market, appear to have stabilized.

Consumption of acid-grade spar may increase, particularly if recently announced plans for expanding aluminum production are fulfilled. Use of acid-grade for chemical purposes also has been increasing.

Consumption of ceramic-grade has been stable and large increases seem unlikely for 1956. Market sharing between domestic producers and importers is not likely to change much unless Government action, through tariffs and other moves, takes place•

FELDSPAR

Brooke L. Gunsallus
U. S. Bureau of Mines

FOREMOST REALIGNMENT of production interests since 1952 occurred in 1955 when Feldspar Corp. of Spruce Pine, N. C. purchased the Feldspar Flotation Corp., also of Spruce Pine, and its affiliates, Feldspar Milling Co., Burnsville, N. C., North Carolina Feldspar Corp., Erwin, Tenn., and Appalachian Mineral Co., Monticello, Ga. Feldspar Corp. is a wholly-owned subsidiary of Pacific Tin Consolidated Corp., New York.

Production, based on the first nine months of 1955, was down 5 to 8% from 1954 crude production and down 10% in production of ground. Imports of crude and ground last year were negligible.

Consumption declined, probably because demand in the glass container and pottery industries dropped as the latter found substitute materials. Flat glass and sanitary-ware consumption also decreased and enameling consumed about the same as 1954.

Appalachian Minerals, the first plant in the U. S. to produce high-potash feldspar by froth flotation from pegmatites, reached full production in 1955. Output was shipped to the glass, electrical porcelain and sanitary-ware industries and to other manufacturers of ceramics.

Del Monte Properties Co., operating a beach-sand flotation plant at Pacific Grove, Calif., from which high-grade feldspar is obtained, reported its best year in 1955 and expects to install additional plant capacity this year.

Flotation of feldspathic ores continued to increase, accounting for about 40% of all marketable feldspar last year, compared with 35% in 1954. Feldspar Corp., since acquiring the new companies, has continued to develop new reserves and has added materially to mining and refining equipment acquired with the purchase.

Bell Minerals Co., through further modernization and mechanization, increased production capacity 40% and developed four new mines during the year.

International Minerals & Chemical Corp., installed an electrostatic concentrating tower at its Topsham, Me., plant to test, on a commercial scale, a dry method of beneficiation. Process eliminates part of the silica and soda feldspar, resulting in a product with a substantially higher potash-soda ratio.

Nepheline syenite imports have increased progressively since 1944, with an increase last year of 21% over 1954 to about 120,000 short tons. Expansion in the glass-container industry, with a corresponding demand for nepheline syenite, explained part of the increase.

Construction of the nepheline syenite plant of IM&CC at Blue Mountain, Ontario, Can., progressed rapidly during 1955, and production was expected early this month. Plant is of concrete and steel construction, representing an investment of $1.5-million and will have an estimated capacity of about 100,000 short tons of ground nepheline syenite per year at the time of full output.

BARITE

Reginald Rowand
National Lead Co.

GREATER PRODUCTION, expansion of processing facilities, additional bulk handling facilities and new handling methods characterized barite activity in 1955. Domestic production (946,744 short tons in 1954) appeared due for a slight increase. World production, also continuing upward, should top the 2.2-million tons produced in 1954. Primary use of barite, as a weighting material in oil well drilling mud, consumed 968,429 tons in 1954. With drills going deeper, and more wells working, consumption for 1955 should also be up.

Oil wells along the Louisiana and Texas Gulf coast consumed over 50% of barite usage. Another market for the material may develop in commercial growth of atomic energy, where its use as an aggregate improves concrete's shielding characteristics. Additional uses in the electronic field are also being researched.

Producing states, in order of probable rank for 1955 are: Arkansas, Missouri, Nevada, Georgia, Tennessee, Arizona, Montana, California, Idaho, New Mexico and South Carolina. Arkansas producers shipped 370,621 tons in 1954; tonnage in 1955 will show an increase. Arkansas ore (50% $BaSO_4$) is mined by open pit and underground methods. Since it must be finely ground for flotation recovery, it is used mostly in the oil well industry.

Missouri production should show a small increase in 1955 over 1954's 318,934 short tons. One producer installed a dry grinding unit to increase capacity; several new washing plants are contemplated or under construction for recovery of crude ore from a mixture of ore and soil which is mined from open pits. Both the chemical and oil industries consume Missouri barite.

Nevada's 1955 output is also expected to pass 1954 (100,448 tons). Nevada ore in the past has been shipped to California processors for use in the chemical and oil industries. This year, one producer will construct his own processing mill near the mine.

Tennessee, South Carolina and Georgia production, all on an upward trend in 1955, divided 88,394 tons between the oil and chemical industries in the year previous. Other states produced some 68,347 short tons in 1954. Increased activity in late 1955 in mining and leasing focused attention on New Mexico. Montana and Arizona continued to supply local oil well drillers.

Increased imports from Nova Scotia are anticipated in 1956, resulting from purchase of one source by a U. S. producer. In 1954, crude product was imported from Nova Scotia, Mexico, Yugoslavia and Italy in that order, in regard to relative tonnages sold, with total imports in 1954 at 317,093 short tons. Ground barite imports in 1954 totaled 252 tons under the current tariff of $6.50 per long ton compared with $3.00 for crude ore. Imported ore is consumed by the chemical industry in the eastern U. S. and seven dry grinding plants on the Gulf Coast. A new barium carbonate plant began operation in Kansas during the past year.

Bulk handling of finely ground barite for the oil industry continued to improve in bulk handling methods and to increase in tonnage. Bulk shipments are made in hopper cars, highway trucks and metal containers, all eliminating use of bags. One producer has a semi self-propelled barge under construction for bulk delivery to offshore oil rigs.

Outlook. Growing demand for barite by the oil industry is increasing competition and exploration for new sources here and abroad. Known domestic reserves are large, but often uneconomic because of transportation costs•

PERLITE

Oliver S. North
U. S. Bureau of Mines

PRODUCTION and sales of crude and expanded perlite and perlite products continued to increase in 1955. Few new plants were built during the year, but there were some ownership changes. Technology and new uses were investigated by processors and by the industry's trade organization, the Perlite Institute. Market for expanded perlite was extended by vigorous sales and engineering effort.

Output of crude and expanded product has reached a new record each year since production data first were collected by USBM in 1946. Total sales of expanded perlite in 1955 were estimated at 220,000 short tons, or approximately 13.2-million four-cubic-ft bags—an increase of 11% over 1954. In most areas, prices for expanded perlite were little changed from the preceding year. Complete statistics are given in the accompanying table.

Over half the total crude perlite produced was mined in New Mexico; remainder came mainly from Colorado, Nevada, Utah and California.

Ownership changes included International Minerals & Chemical Corp.'s acquisition of the Big Pine, Calif., perlite mine and mill of U. S. Mining Co. and the Los Angeles expanding plant of Peerless Perlite Co. in a move toward further diversification of the company's mineral interests. The new owner reportedly will focus attention on developing products that use perlite.

Great Lakes Carbon Corp., Los Angeles, took over operation of the Klondike, Calif., mine and mill of California Perlite Corp. Property became Great Lakes Carbon's third operating perlite mine. Principal markets for Klondike crude rock were expected to be the expanding Los Angeles plants.

Two new perlite-products plants were built during 1955 by F. E. Schundler & Co., Joliet, Ill.; one at Joliet for production of roof insulation board and the other at DeKalb, Ill., in which acoustical tile is manufactured.

U. S. Gypsum Co., Chicago, began operating its new mill at Grants, N. M. Company used the bulk of its output of crude perlite in its own furnaces at gypsum products plants that produce premixed perlite plaster.

Possibility of importing perlite from Iceland was being investigated thoroughly at year-end. Several deposits have been found, one on the east coast and near a deep-water fjord. Deposits in Italy and Greece also are considered potential sources of crude material for processors on the east coast of the U. S.

Nearly all perlite expanding plants sold sizeable quantities for use as plaster aggregate, and a part of most plant output was sold for concrete aggregate. Perlite Institute estimates that perlite aggregate was used in 40% of all base-coat plaster applied in the U. S.

An estimated 165,000 short tons of expanded perlite was used in 1955 in plaster, 30,000 tons in insulating concrete, 10,000 tons in oil well muds and concretes and 6,000 tons as a filter aid. Smaller quantities were used for loose-fill insulation, horticultural purposes, paint filler, oil absorbent, refractory brick, exterior cement stucco, packing ceramics and other fragile articles, and abrasive and in foundry industry to insulate risers and as an additive to core and facing sands.

In the southwest a white, lightweight building block was made, using

Perlite Statistics
(Short tons)

	1954*	1955 estimated
Crude perlite		
Sold by producers	154,531	200,000
Value, total	$1,375,706	$1,800,000
Average per ton	$8.90	$9.00
Used by producers	65,172	80,000
Value, total	$386,394	$480,000
Average per ton	$5.93	$6.00
Total sold or used	219,703	280,000
Value, total	$1,762,100	$2,280,000
Average per ton	$8.02	$8.14
Expanded perlite		
Sold or used	195,499	220,000
Value, total	$10,278,745	$11,660,000
Average per ton	$52.58	$53.00

*U.S. Bureau of Mines MMS Report 2450.

perlite and diatomaceous earth aggregates. One of the growing uses noted during the year was gun-applied perlite concrete curtain-wall construction.

Small-to-moderate foreign production is credited to Australia, Ireland, Italy, Japan, Mexico, New Zealand and Venezuela. It is believed that perlite plants were active in those countries, as well as in Canada, England and France. Except for imports of crude perlite into Canada from the U. S., to England from Ireland and Italy and to France from Italy, there was little international trade in crude. Transportation costs prevent movement of expanded perlite between nations except as components of other finished and/or semi-finished products.

Outlook. Industry anticipates a sharp increase in use of expanded perlite in concrete roof decks, gun-applied curtain-wall construction, and as a filter aid. One firm is promoting perlite as an insecticide carrier and others are developing applications of perlite mixed with binders other than Portland cement and gypsum—asphalt, plastics, etc.

Most production authorities predict another record year in 1956, particularly in industrial construction, where perlite is used in large quantities. Perlite Institute has forecast another 15% increase in consumption for this year•

VERMICULITE

William S. Steele
American Vermiculite Corp.

OUTSTANDING DEVELOPMENTS in 1955 were in the production of precast vermiculite compositions, in pesticides and fertilizers and in the steadily increasing use of vermiculite-gypsum plaster.

Domestic production increased more that 10% and South African imports moved upwards approximately 16% over the 1954 figures with total volume from both sources aggregating 250,000 tons. This is equivalent to more than 80-million cubic ft of exfoliated vermiculite.

Price changes in domestic ore and variations in ocean freight rates altered grade prices to some extent but crude ore prices on domestic vermiculite ore remained in the bracket $9.50 @ $14.50 per short ton (f.o.b mine). South African crude vermiculite ranged from $27.00 @ $34.00 per short ton (c.i.f. U. S. ports).

Dealer prices on exfoliated vermiculite were virtually unchanged with delivery in truck load quantities running from 90c to $1.35 per 4-cubic ft bag depending upon locality, grade and specifications.

Zonolite Co. continued to improve its processing program in South Carolina and American Vermiculite Corp. extended its plant operations to the Pacific Coast with its Amverco/Transore South African ore. Transvaal Ore Co., Ltd., consolidated its mining and processing activities at Palabora, Transvaal, and the industry as a whole is in an excellent position to handle its steadily increasing demand.

Several discoveries of vermiculite deposits were reported during 1955, principally in Uganda, Mexico and Nyasaland, but preliminary surveys indicate that none of these will be economically or competitively available for American exfoliating plants.

Home insulation, concrete and plaster aggregate, vermiculaponics, acoustical plaster, high temperature coatings, underground pipe insulation, spandrel wall backing and low temperature fills, as well as precast and molded articles; fired and air-set refractories were among the larger uses for vermiculite in 1955. Vermiculite, over a period of more than 20 years, has proven to be free from the danger of delayed chemical reaction or volumetric expansion. This field experience has been largely responsible for its growing demand for fireproof plaster, lightweight concrete and other structural uses.

Machine applied vermiculite concrete is now used as an insulating backing for metal and masonry spandrels; and for stack linings.

Vermiculite Association, Inc., has broadened its membership base to include exfoliators and processors of vermiculite all over the world with cooperating members in the United Kingdom, Australia, South Africa, Norway and Holland. An additional research establishment with headquarters in London known as Mandoval Research Committee, sponsored by Mandoval Ltd., Transvaal Ore Co. Ltd. and American Vermiculite Corp. now has a competent staff and laboratories which supplements but does not duplicate the American program.

Outlook. A substantial increase is anticipated in 1956, particularly in building construction, where gun applied vermiculite-gypsum plaster is replacing dry wall construction, and in light weight fireproofing and insulating concrete. An extension in the number of vermiculite processing plants is contemplated, and a number of new uses now in the development stage are expected to further influence the vermiculite market•

PHOSPHATE

H. F. Dengler
International Minerals & Chemical Corp.

PRODUCTION IN THE U. S. during 1955 was adversely affected by a prolonged strike in the Florida mining field. It is felt that this strike, which in the case of at least one mine, lasted as long as four months, led to a drop in output of about 1.5-million long tons, from 10.4-million tons in 1954 to 8.9-million tons in 1955. Second in importance is now the Western Phosphate Field, where production reached a new

high of some 2.2-million tons. The third field, Tennessee, should have maintained the 1954 output of 1.6-million tons.

Florida shipments were only slightly reduced by the strike, as ample stocks were available. Deliveries for domestic and export destinations should have been approximately 9.5-million tons as against 9.7-million tons in 1954. All this was Florida Land Pebble Phosphate ranging in grade from 66% to 77% Bone Phosphate of Lime (BPL) and only some 80,000 tons each was Florida Hard Rock and Florida Soft Rock. Because of increased cost there was a tendency toward higher prices. The average price per ton f.o.b. car at the mines was about $6.25; the average grade 72% BPL. In 1955 Florida will have exported about 1.8-million tons mostly to Europe and to Japan.

There are eight mining companies operating in the Florida Land Pebble field:

American Agricultural Chemical Co.—except for installing automatic controls on matrix handling pumps, no changes in their mining and preparation installations have been reported. They have, however, started operating a second electric phosphorus furnace with a designed capacity of 12000 kva. They are also constructing a plant to produce an expanded slag by the TVA process; product will be used as a light-weight aggregate for use in concrete.

American Cyanamid Co. reports operations continued at a normal annual rate without major expansion or capital outlay. It is anticipated that their Saddle Creek Mine will be exhausted toward the end of 1956, when the plant will be dismantled and moved to a new location northeast of Lakeland. New operation will be known as Orange Park Mine. Company will build a 200,000 ton per year triple superhosphate plant at Brewster. Construction is about to begin and completion is foreseen by mid-1957.

Armour Fertilizer Works completed their mining project late 1955. Recovery operations were started in September. This is a well-rounded modern phosphate mine with washer, flotation and drying plant. Mining equipment consists of one 770-B Bucyrus-Erie dragline equipped with a 195-ft boom and 20-cu yd bucket and one B-E 180-W dragline with 120-ft boom and 6-cu yd bucket. The washer and flotation plant make use of DorrClones for primary desliming. Coarse concentration will be done on belt concentrators and fine concentration by flotation. Mine is located adjacent to the company's triple superphosphate plant near Bartow.

Phosphate Statistics
(Thousands of long tons)

	1954	1955 estimated
Florida	10,437	8,900
Western Fields	1,750	2,200
Tennessee	1,633	1,600
Total U. S.	13,820	12,700

Coronet Phosphate Co.—Division of Smith-Douglass Co., Inc., completed several improvements in their flotation plant resulting in improved metallurgy. Additional phosphate rock land was acquired, increasing their rock reserves.

A new potassium silicofluoride plant is being constructed in conjunction with the operation of the defluorinating phosphate plant at Coronet.

Davison Chemical Co. has installed a new material handling system to remove and stack overburden. Equipment consists of two Bucyrus-Erie 54-B draglines equipped with 70-ft booms and 3½ cu yd buckets. Draglines feed two hoppers—one for each dragline, six 100-ft feeder conveyors, a 1200 ft conveyor and one stacker conveyor with slinger. At the present time, 6 to 20 ft of overburden is being removed by this method to reduce remaining overburden matrix ratio to where it can be handled by a single dragline.

International Minerals & Chemical Corp. continued to operate 3 mines (Noralyn, Peace Valley and Achan) and the drying, grinding and shipping plant at Mulberry. There was no major expansion or capital investment, but a number of improvements and refinements were introduced.

One of the results of the long strike this summer was the signing of a 4-year labor contract without the reopening clauses. This should assure the uninterrupted supply of phosphate rock at least for this period.

At their Bonnie phosphate chemical plant the IM&CC completed the extension program into triple superphosphate and is now producing this material at an annual capacity of over 200,000 tons.

Swift & Co. did not report new developments in their operations.

Virginia-Carolina Chemical Corp. undertook several large-scale test projects. Although the construction and operation of two unprecedented pipe line transportation systems have been previously reported, these pipe lines figure prominently in one of the projects. During the year, they were used to effectuate an original, complete mining system.

The application of the system required, among other things, that two flotation plants, 9 miles apart, be supplied with feed from an approximately central source, in the absence of any mining and washing operation during the test period. Feed for the two flotation plants was previously accumulated. The project was outstandingly successful from the standpoint of uniformity, high grade of product, increased plant output, increased recovery and improvement of costs.

Following the end of a two and a half months' strike, demand for the company's product was of such magnitude as to constitute a real test for the new wet storage, drying and shipping facilities which had been provided and put into operation in 1954. For a period of more than a month, all of these facilities performed with ease at a rate in excess of 130% of designed capacity.

Only major construction project undertaken during the year was in connection with the large triple superphosphate plant at Nichols. Temporary provision was made for the complete elimination of both gaseous and liquid plant discharges of an objectionable nature. Although the plant, as originally constructed, contained provision for the removal of most of such materials, steps have been taken to eliminate them completely. The temporary provision will continue to function until the permanent installations can be completed.

A development of major importance in the Florida field is the erection of a number of large size triple superphosphate plants by either miners or fertilizer (customers) companies. There are now seven such plants in operation in that area with a combined estimated capacity of 1.4-million net tons; another plant of 200,000 tons capacity will soon be built. Some 2.5-million tons of phosphate rock are needed to make this amount of

triple super. This move has led to noticeable changes in the marketing of the phosphate and still more in the economics and technology of the fertilizer industry.

Western Phosphate Field — The 1955 mining year proved to be another good year in the Western Phosphate Field in both the mining of phosphatic shales for the chemical industry and the mining of phosphate rock for the fertilizer industry. Mine production showed an increase over past years in most of the producing areas of the western field, These areas are in the mineable portions of the vast Phosphoria Formation which blankets this portion of the intermountain west. The producing areas are located in four of the western states, Idaho, Montana, Utah, and Wyoming.

Total production in the West is about 2.2-million tons. Of this amount, about 53% was mined underground and about 47% on the surface. Average grade of the western rock mined was between 27 and 28% P_2O_5.

Idaho retained its leadership in the production of phosphate during 1955 with an estimated total tonnage of 1.5-million tons. Companies active in the mining of phosphate in Idaho are: Anaconda Co., Monsanto Chemical Co., San Francisco Chemical Co., Westvaco Chemical Division, Food Machinery and Chemical Corp., and J. R. Simplot Co.

Anaconda Co. continued mining phosphate rock by both open-pit and underground methods at their Conda Mine near Soda Springs, Idaho. This mine is one of the oldest in Idaho, and only during the past few years has the open-pit method of mining been practiced. During 1955, both phosphatic shales and phosphate rock were mined with approximately 80% of the material being used for fertilizer at their fertilizer plant in Anaconda, Mont., and approximately 20% being used by the chemical industry.

Monsanto Chemical Co.'s installation of another electric furnace in 1954 produced the need for an increase in mine production in 1955 from their open-pit mine located north of Soda Springs. Entire mine-run production is shipped to their elemental phosphorus plant in Soda Springs.

San Francisco Chemical Co., with headquarters at Montpelier, Idaho, continued underground mining operations at a couple of places in the Crawford Mountains in northern Utah, continued their strip and beneficiation operations at the Leefe property in southwestern Wyoming, and at their Dingle-Hot Springs property, 15 miles or so south of Montpelier, Idaho, drove a 1600-ft crosscut eastward which intersected the vein about the same distance below the surface and have since been carrying on development work and raises and drifts on the ore at this point.

Westvaco Chemical Division retained its Western Field leadership in the production of elemental phosphorus from its plant located near Pocatello, Idaho. The phosphatic shales used here were obtained from the J. R. Simplot Co.'s Gay Mine. They also obtained phosphate rock from their leases on the Fort Hall Indian Reservation located near the Gay. Open-pit mining was started during 1955.

J. R. Simplot Co. continued mining at the Gay Mine on the Fort Hall Indian Reservation near Pocatello. Phosphatic shales and phosphate rock were mined with the phosphatic shales shipped to the Westvaco plant near Pocatello, for the production of elemental phosphorus. Remaining mined tonnage was shipped to Simplot's fertilizer plant near Pocatello, for production of single and triple superphosphate.

An improvement and expansion program has been carried on during the past year at Simplot's fertilizer plant. This program has increased their needs of phosphate rock during 1955, and will increase them to an estimated 150,000 tons in 1956.

An exploration and development program has been carried on by J. R. Simplot for the past two years on a large phosphate deposit in the Centennial Mountains on the Continental Divide between Idaho and Montana. Plans are to start mining in 1956.

No new developments were announced concerning the Central Farmers Cooperative which holds phosphate property near Georgetown, or the other non-operating companies which hold phosphate land.

Montana ranks second in the production of phosphate in the western field. The active companies are the Montana Phosphate Products Co. and Victor Chemical Works. Montana Phosphate Products at Garrison, mined the bulk of the phosphatic material produced in the state by both open-pit and underground methods. Total production was shipped to Canada for the manufacturer of fertilizer by the parent company, Consolidated Mining & Smelting Co.

Victor Chemical Works operate phosphate mines at Melrose and an elemental phosphorus plant at Silver Bow. In the spring of 1955 they installed a washing plant at their furnace near Silver Bow and concurrently switched their mining operations at the Maidenrock and Canyon Creek mines some 30 miles south to wider mining widths and lower grade ore. This will permit cheaper mining costs, although of course it will result in a lower grade feed, hence the reason for the washing plant.

Western Phosphates, Inc. although not active in mining at present, operate a fertilizer plant at Garfield, Utah.

With the planned mining of newly developed properties and increased production in existing mines, and with growing demand in the chemical and fertilizer industries, 1956 should see an even greater volume than the record established in 1955.

Tennessee field during the year should have produced some 1.6-million tons which is mostly used locally in electric furnaces for conversion into elemental phosphorus; a part is ground for direct application to the soil and the rest is used in the manufacture of fertilizers. Some of the more important happenings in 1955 are reported as follows:

Shea Chemical Corp. announced a $5-million expansion program in April which included two additional nodulating kilns and an additional furnace at their Columbia plant.

International Minerals & Chemical Corp. purchased the TVA Godwin plant on June 8, 1955, and announced intention to expand washing facilities. Construction is now underway. It was also announced that International would eventually establish phosphate rock drying and grinding facilities at this location. Mining and washing operations will start in the spring of 1956. With the acquisition of the Godwin plant, IM&CC is provided with facilities conveniently located for processing their large holdings in Maury County, in the Dark's Mill area.

Monsanto Chemical Co. announced a 1-million modernization program in

June, primarily for the handling and preparation of phosphate matrix for furnace feed.

M. C. Boyle Phosphate Co. started mining phosphate rock on the Bratton property near Duck River, in the spring. Company is engaged in washing, drying, and grinding phosphate rock for direct application to the soil.

Interest in re-leveling the mined-out areas in the Tennessee phosphate field is growing continually. Meetings between Farm Bureau member, interested farmers, industrial representatives, and phosphate mining contractors have been scheduled.

TVA reports the following phosphate activities during 1955.*

TVA purchased a tract of land during the year in the hard rock phosphate district of Citrus and Marion Counties, Fla.

Mining of phosphate matrix was continued in the Knob Creek area of Maury County. Mining was finished in the Bear Creek area and restoration of the land for agricultural purposes was completed.

TVA's phosphate matrix washing plant and fused tricalcium phosphate fertilizer plant near Columbia were sold at public auction in June to IM&CC.

At Wilson Dam, Ala., phosphate matrix from Tennessee is blended with purchased Florida pebble to make electric phosphorus furnace charge. The blended phosphate is either nodulized in rotary kilns or is briquetted and calcined in a shaft kiln or rotary kiln. The briquetting equipment operated satisfactorily at a rate of about 30 tons per hour. Calcined briquets were produced in the shaft kiln at a rate of 16 tons per hour with excellent heat economy. Tests of the unit are continuing.

Electrostatic precipitators installed last year for the removal of dust from gases leaving the nodulizing kilns did an effective job of cleaning the kiln gases. Construction was started in the fall on a unit to remove fluorine from nodulizing kiln gases by a water-scrubbing process. Fluorine-bearing water will be neutralized either by percolation through the plant slag pile or by the addition of lime.

Further studies were made of methods of beneficiating Florida leached zone phosphate and pilot-plant tests were continued on a process for producing fertilizer from the ore. Of most promise is a nitric phosphate process that permits recovery of uranium and the production of concentrated fertilizer such as 15-15-15 grade. A pilot-plant run was made to demonstrate the process to representatives of industry who were invited by the Atomic Energy Commission.

The experimental production of diammonium phosphate fertilizer was started during the year. Research also was continued on the development of several other promising phosphate fertilizer processes.

World Phosphate Picture—It is expected that during 1955 a total of 28.5-million tons of rock has been shipped in the world. Of this figure the U.S. holds the lead with 13.3-million tons. North Africa (Morocco, Tunisia, Algeria and Egypt) is estimated to have produced 8.5-million tons, this in spite of the serious troubles the French had in their North African territories (*E&MJ* September 1955, p. 212). The riots interfered to a slight degree with mining, but shipments were not affected since sufficient stocks were available to maintain normal deliveries. The Pacific Islands, namely Ocean, Nauru, and Christmas Island, operated by the British Phosphate Commissioners, plus Makatea, should have a total of 2.5-million tons. Of the "other producers" Russia is the most important and of the 4.2-million tons estimated for all other production centers Russia alone should have some 3.7-million tons. The estimated world figure of 28.5-million tons would be a new record and continues the trend of ever-increasing world consumption of phosphate rock in a greater number of applications.

In line with the ever-increasing demand, new deposits are being developed and most prominent in the picture are new mines in Trans-Jordan, Brazil, and West and South Africa. Before long these new production centers will enter world markets with an estimated additional tonnage of 1-million tons•

*Supplied by Dr. J. H. Walthall, Director, Division of Chemical Development, Tennessee Valley Authority, Wilson Dam, Alabama.

ASBESTOS

Walter A. Rukeyser
Consulting Engineer

CANADA, for the first time in its long history of asbestos production, in 1955 produced over 1-million tons of chrysotile; in fact, Quebec alone reached the million mark. Impact of production on such a scale is emphasized when it is remembered that a mere two decades ago output was barely a quarter of this amount. Approximately 55,000 tons of daily milling capacity produced fiber with still an additional 10,000 tons envisioned for the immediate future.

Asbestos Prices Jan. 1, 1956

(Short tons in bags)

Group	Minimum guaranteed Tests	Price
1	Crude	$1,410.00
2	Crude	760.00
3	7-7-1½-1 to 0-8-6-2	565 to 353.00
4	0-4-9-3 to 0-2-10-4	190 to 172.00
5	0-½-10½-5 to 0-0-10-6	135 to 114.00
6	6D-0-0-7-9	82.00
7	0-0-5-11 to 0-0-0-16(7R)	72 to 41.00
7RF & 7TF	No test	42.00
8S	845 and 856	36 & 26.00

Statistics alone do not reflect the basic economic trends within the industry. As this review has emphasized from time to time in recent years, the rate of increase in the production of the relatively low-priced shorts has been inordinately great compared to the increase in sales of high-priced milled fibers and crudes and 1955 proved to be no exception. Whereas in 1954 the shorts accounted for 64.6% of total tonnage shipped from Quebec, in 1955 the actual figures for the first ten months of the year showed the ratio to have risen to 66.6%. The relatively expanding shorts market and diminishing longer-fiber demand in terms of gross national output in the U. S. are shown in the accompanying tables.

With 1938 (the last full year before

the start of World War II) taken at 100, U. S. gross product in 1954 stood at an index factor of 400; shipments from Quebec of the spinning, shingle and paper grades at a mere 200 and the shorts at 480. For the year just passed the estimated indices in terms of 1938 are: U. S. gross product, 428; "milled" fiber shipments, 210 and shorts, 540. If these estimates prove correct, this means that an increase of 7% in the U. S. output over 1954 was accompanied by a 5% increase in shipments of milled fibers and a 12½% increase in shorts.

Apropos of the above situation, the Quebec Asbestos Mining Association made public the results of a survey published in the *Asbestos Producer* for April: "The potential supply of spinning fibers", the report stated, "is now considerably in excess of any probable international demand even in a period of emergency. . . . On the basis of installed mill capacity on Jan. 1, 1955, the Canadian asbestos industry is able to produce an annual total of 63,072 tons of Groups 1, 2 and 3. This could be increased by another 8,000 tons per year of high-grade Group 3 fibers in a very short time if an emergency arose. These figures compare with a total of 28,030 tons per year during the war and 35,027 tons per year during the Korean crisis. . . . Normal demands in the textile industry are not sufficient to use this production potential."

Further aggravating the situation are long-fiber developments elsewhere than Canada which commenced contributing to world supply during 1955. Southern Rhodesia's new Temeraire mill and Venezuela's Tinaquilla district should in the current year add a combined tonnage of 35,000 or 40,000 tons to the supply of textile and asbestos-cement chrysotile. Proposed large-scale expansion of Cape Blue (crocidolite) and Amosite will further augment the production of these grades.

Despite the fact that a buyers' market now exists resulting in a highly competitive situation wherein the strongest, most uniformly graded, dust-free fiber naturally is preferred, Johns-Manville and the Asbestos Corp. have at year's end posted increased prices of about 5% for the longer grades and 10% for the shorter. This is the first increase since 1952. New Asbestos Corp. prices effective Jan. 1, 1956 are shown in the accompanying table at left.

In 1954 the Canadian mining industry mined 14,794,000 tons of rock

Quebec Shipments Compared With U. S. Gross National Product

(12-month period, short tons)

	1938	1948	1953	1954	1955
Crudes	2,911	977	781	725	725
Spinning, shingle, paper	163,097	241,953	327,121	326,653	344,275
Shorts, etc.	123,785	473,839	584,105	596,738	675,000
Total all grades Shipped	289,793	716,769	911,226	924,116	1,020,000
Produced	—	—	920,191	936,807	1,040,000
Value (shipped)	$12,890,195	$42,231,475	$86,052,895	$86,409,212	$96,000,000
Av. fiber pt.	$44.40	$58.90	$94.40	$93.50	$94.00

	1938	1948	1953	1954	1955
U. S. gross product (billions)	$ 90	$225	$365	$360	$385
1938 = 100					
U. S. product	100	250	400+	400	428
Spinning, shingle, paper	100	150−	200−	200	210+
Shorts, etc	100	380+	470+	480+	540+

Canadian Asbestos Shipments by Grades

(Short tons including any for own use)

	October		10 months	
	1954	1955	1954	1955
Quebec—				
Crude—No. 1, No. 2, other	42	36	500	463
Milled—Group 3 (spinning)	3,095	3,162	24,943	26,569
Group 4 (shingle)	15,453	20,338	134,472	158,842
Group 5 (paper)	9,123	10,303	81,699	93,227
Group 6 (stucco)	16,315	13,890	141,098	145,496
Group 7 (refuse)	38,045	44,096	330,336	385,107
Group 8 (sand)	2,930	1,951	27,746	23,421
Total all grades	85,003	93,776	740,794	833,125
Canada	88,394	97,583	765,217	880,096

Canadian Asbestos Exports

(Short tons)

	September		9 months	
	1954	1955	1954	1955
Crude	42	52	436	415
Milled fibers	30,138	34,213	218,392	256,484
Waste, refuse, shorts	53,466	52,759	418,217	465,550
Total	83,646	87,024	637,045	722,449

Prepared in the Mineral Statistics section, Industry and Merchandising Division, Dominion of Canada Bureau of Statistics.

Canadian Chrysotile Asbestos Shipments

(10-month period, short tons)

	1953	1954	1955
Quebec			
Crudes	601	500	463
Spinning, shingle and paper	251,263	241,614	278,638
Shorts, etc	487,657	499,180	554,024
10 months	739,521	741,294	833,125
12 months (estimated)			1,070,000
Canada			
10 months	762,862	765,217	880,096
12 months (estimated)			1,075,000

which produced 11,395,000 tons of mill feed. Hence some 3,399,000 of waste resulted or 23% of the tonnage mined. The gross value of fiber from this ore, some $87-million, gives an average place-value per ton mined and milled of $5.88 and $7.63 respectively. Of the total value of all fibers produced the short grades accounted for some $28.5-million or slightly under one-third. Hence, almost two-thirds of the fiber produced was responsible for only about one-third the dollar value. Based on a daily milling capacity of about 55,000 tons a day, estimates for 1955 bring the tons mined for the year to say, 20-million. With the ratio sent to waste assumed as 25%, the tonnage milled should approximate 15-million tons.

Costs for 1955 in Canada rose but slightly if at all compared to 1954. One major-company official told the writer that 1955 costs kept pace with the general commodity and cost-of-living indices; but these rose only fractionally in 1955. In fact, due to increased production and the inauguration of new, efficient and more economical plant, unit costs quite possibly decreased over the preceding year. In 1954, $24,850,000 was earned by 6,563 employees; supplies aggregated $14,161,000; fuel and electricity, $4,131,000 and taxes (all), $9,185,000. Thus costs before plant replacement, depreciation, depletion, insurance, etc. totaled $52,327,000 or $3.54 per ton mined and $4.59 per ton milled.

In Quebec, 1955 witnessed the closing in February of the famous 35-yr old Vimy Ridge mine and mill of the Asbestos Corp., followed a few days later by the initiating of production at the new Normandie mill nearby. The Normandie added about 3,000 tpd net rock capacity. However, it produces a much softer fiber than did the Vimy; so the harsher, higher-drainage-rate, premium shingle-fiber from the latter will no longer enter the market. The year also saw the nearing completion of all units of the mammoth new Johns-Manville mill at Asbestos, which in 1956 will be able to operate at a fiber production rate of 625,000 tons a year. The year just passed saw Nicolet's milling rate jumped to 3,500 tpd and the purchase at auction from Bell, at a reputed price of $3-million, by National Gypsum of a virgin property near Thetford Mines, containing 40-million tons of ore to the modest depth explored to date. It is believed a mill will be erected on this property in the near future to supply National Gypsum with their requirements in the manufacture of asbestos-cement products at New Orleans, St. Louis and Millington, N. J.

Value of Quebec Asbestos Shipments

(Thousands of dollars)

	Average per ton	1954 10 months	1955 10 months
Crudes 1, 2, etc.	$1.000	$ 500	$ 463
Group 3	.370	9,250	9,842
Group 4	.170	22,865	27,030
Group 5	.115	9,396	10,695
Group 6	.075	10,583	10,913
Group 7	.040	13,212	15,404
Group 8S	.019	526	468
Quebec: 10 months total		$66,332	$74,815
Canada: 10 months total		68,850	84,215†
12 months total		86,409	96,000†

†Estimated.

Highlights of Asbestos Corp. operations for 1955 are supplied the writer by George Jenkins, general manager:

"Four mines were operated; King, Beaver, British Canadian, and, when Vimy was closed down the middle of February, Normandie came into production a few days later. The over-all rate of mining is, roughly, 17,000 tons ore, 17,000 tons waste rock, 12,000 tons overburden, totaling 46,000 tpd. Present capacity of mills in tons per day are, King—3,500, Beaver—3,500, British Canadian—5,000 and Normandie—5,000.

"Fiber production has been up moderately compared with 1954.

"The Normandie plant was built to treat the ore from a large new body, which was found under a wooded swamp to the north of Vimy Ridge Mine. It was drilled systematically to a depth of 1,000 ft, proving 35,000,000 tons (as published in company's 1954 annual report) of ore containing fiber of consistently uniform and good quality. The fiber is whiter and less brittle than that of the adjoining Vimy Ridge mine. Over 5-million cubic yards of stripping was done to prepare the mine for open-pit operation. Mining is by 5-yd shovels and 22½-ton trucks. Crushing is by two 48x60-ft jaw crushers, followed by two 5½-ft cone crushers. Drying is by a combination of vertical and rotary dryers. Crushing and drying capacity is designed to operate two shifts per day, 5 days a week, to supply mill treating 5,000 tpd for 6 days per week. A 3,000-ton surge bin has been provided before dryers, followed by a 30,000-ton bin ahead of mill. The primary section of mill has been designed around six 17-ft Aerofall mills. The secondary portion of the mill, where fiber is cleaned and graded, operates independently of primary section by virtue of concentrate bins."

Johnson's Co., having placed its new Black Lake mill in operation in 1954, continues open-pit mining there and block-caving at Thetford. Bell Asbestos also has nothing new to report for the year just passed, except the sale of its shorter-grade fiber property three miles northeast of Thetford to National Gypsum. However, a project of major importance comprising a joint venture of Johnson's, Bell and the King mine of Asbestos Corp. in the form of Relocations Limited is rapidly achieving its $6-million program to provide for the effects of subsidence from block-caving their common Thetford orebody on the town of Thetford Mines.

Quebec Central Railway's mainline as well as Highway No. 1 (Sherbrooke to Quebec) have already been moved some three miles west of the town. Leigh Bladon, the manager, has advised the writer that new water-works which were required have been installed on Mooney and Pie XI streets; waterworks and sewers also have been completed in the townsite and 65 private buildings and business establishments of a total of 160 (exclusive of company-owned plant) relocated.

Original plans (when block-caving was first introduced at Thetford by the three companies in question) envisioned a 50 deg angle of subsidence. To provide for the removal of deeper blocks of ore after experience had shown that the fill, consisting of mill tailings, would not prevent damage to the town, an angle of 40 deg is now planned. The removal of certain portions of the south end of Thetford adjacent to the orebody will add some 30 years to the life of the operation by permitting deeper mining. The cost is being borne jointly by the three companies pro rata according to the additional ore made available to each by the project.

Lake Asbestos, the subsidiary of American Smelting & Refining which operates the mines of United Asbestos, continued the draining of Black Lake preparatory to the operation of its proposed 4- to 5,000-ton mill in 1957 or '58. As before mentioned in the asbestos review, this company anticipates

an annual fiber output of some 108,000 tons, most of which will be in Groups 3, 4 and 5.

Flintkote, which commenced operations on the Pennington Dike in 1946, is planning a $3-million expansion of its present facilities 3½ miles northeast of Thetford. The mill rate is being raised from 1,500 tpd to 2,250 and large-scale stripping operations to provide for deeper open-cut mining are being pushed vigorously. Ore reserves sufficient for an additional 12 years of open pit mining are available on this property. Flintkote has also acquired a large, high-grade orebody in Ham Township in the general vicinity of Asbestos some 30 miles to the southwest of Thetford. This will be held in reserve until the depletion of its original mine. Company officials advise that if more success in the disposal of 3 Group fibers to non-company buyers is not effected, asbestos-cement manufacturing facilities to utilize these grades may be considered.

Nicolet Asbestos has in the year just passed advanced its milling rate from 2,000 tpd to 3,500. This company is still actively exploring outside properties and maintains two diamond drills in continuous operation in the Eastern Townships of Quebec.

Quebec Asbestos, a subsidiary of Philip Carey Co. at East Broughton, some 20 miles northeast of Thetford, is erecting a new 100-ton an hour mill to treat its new, large orebody. $7.5-million will be expended on the property. The new orebody contains little long fiber but is extremely rich in shorts and the medium grades required by the parent manufacturing company.

Development of several non-captive ore occurrences continue. A Belgian group is reported to have purchased the Continental mill and mine at Coleraine; work continues at the properties of Golden Age, Lafayette and American in Dorchester County northeast of East Broughton; and plans are under way for Provincial at Coleraine and Asbestos Producers between Black Lake and Thetford.

Elsewhere in the province two important occurrences have been diligently explored and are now under development. The first of these consists of Arizona-type iron-free fiber at Eastern Asbestos Co. Limited 5 miles west of the village of Notre-Dame de la Sallette, 17 miles north of Buckingham in western Quebec. Deposit contains the only iron-free fiber in Canada. It occurs in serpentized dolomitic beds dipping 35 deg to the east conformably with and included in the Grenville crystalline limestone series. In 1955, 16,000 ft of diamond drilling indicated four roughly-parallel serpentine zones carrying an extremely white, strong, silky, iron-free fiber in grades from No. 2 crude down. Zones vary from a couple of feet to as high as 12 to 15 ft in width. Asbestos content is relatively high with large sections running up to 18% and some banded zones as high as 50% or better. Over 900 ft of cross-cut adit, cross-cuts and drifts have already been achieved for development of the ore underground at highway level some 100 ft below the crest of the North-South ridge which conforms to the strike of the orebodies. This underground development is being continued into 1956. A 10-ton an hour mill for treating the high-grade serpentine "concentrates" derived from development headings has been authorized for completion during the present year. The deposit has been indicated for a distance of slightly over 1,000 ft along the strike and 560 ft down dip (in the deepest hole drilled to date). The fiber is of a type which is in strong demand; it should command a premium, even in the present market, for all grades including a minimum 200-mesh filler which is unique in the whiteness of its color and other characteristics.

In the Chibougamau copper district of Quebec, 150 miles north of Lake St. Jean, the deposits of Asbestos Island, which have been known for almost 50 years, are now under active exploration by Chibougamau Asbestos. The claims which are owned by Quebec Chibougamau and Obalski Mines jointly, look promising. Work to date has disclosed an ore zone 1,300 ft long with a reported average width of 350 to 375 ft. Trenching during the past summer has reportedly indicated an ore potential of "not less than 30,000 tons of ore per vertical foot. Exposures have, so far, been opened up for a vertical height of 190 ft. Grades so far exposed have been excellent with crude grade fibers up to 5 in. in length."

Outside of Quebec, at Mathieson, Ontario, Johns-Manville continues to produce some 2,000 to 2,500 tons of fiber per month. Anticipating the future, the company is well underway with a proposed 850 ft vertical 5-compartment shaft with the view to block-caving from the 600 level by 1958. An asbestos manufacturing plant is being built at nearby North Bay to utilize a goodly proportion of the Mathieson output locally.

In northern British Columbia, Cassiar's operations have now been pretty well stabilized and the results have met all expectations. J. D. Christian, general manager, has advised the writer that in 1955 mining operations were seasonally resumed on June 6 in the "cirque" at a point 1,000 ft north and 350 ft below the mine workings. By Sept. 30, some 29,325 tons of cirque development ore and 147,534 tons of mine ore had been delivered to the mill (which operates on a year-round basis at better than 500 tpd). Total ore delivered to the mill during the 1955 mining season was 213,424 tons of which there were 47,350 tons in dry rock storage and 72,440 tons in the stockpile, sufficient to supply the mill from the cessation of mining operations Nov. 4 to resumption in June 1956. Grade was maintained at better than 10%; output consisting entirely of excellent low-iron fibers in the high 3 and 4 Groups. Raybestos-Manhattan and Turner-Newall each have a large interest in the company so fiber sales are greatly simplified and at year-end all production was sold. Additions and improvement to mill and dryer-plant during the year resulted in lowered operating costs and increased capacity. Two weeks work in the coming spring will see the completion of the new aerial tramway. Additional bunkhouses, school, hospital were built.

In 1955 Venezuela saw the fulfillment of recommendations made by this writer three years ago and initiated by him in October 1953. The Tinaquilla district gave promise on first inspection the year previous of becoming a major supplier of Group 3 and 4 asbestos-cement fibers. Pursuant to initial report, the Montañita property, which had been previously partially explored by Turner-Newall, was purchased outright simultaneously with the acquisition of Canacit's El Tigre mine, mill and power plant. Properties lie some 6 miles apart along a continuous serpentine belt and the intervening ground was acquired by denouncement. Ore reserves above the valley floor at Montañita were estimated at just below 5-million tons with an additional 1-million at El Tigre and an unknown, but large tonnage on the Casupo and Casupito claims. In 1953 Amveco, C. A. was formed as a Venezuelan subsidiary of World Commerce Corp. of New York to acquire Montañita, El Tigre and almost all of the entire serpentine belt between. A new flowsheet for the mill was planned; road-building and stripping are well advanced at Montanita. The new open-pit was started

(Continued on p 250)

POTASH

Donald L. Libbey
U. S. Potash Co.

DOMESTIC PRODUCTION in 1955 was well over 3-million tons of refined products, an all-time high. The European market was strong and imports of foreign potash into the U. S. were substantial. U. S. Tariff Commission conducted hearings in the fall following a finding by the Treasury Department of the dumping of potash from several European sources.

World reserves of potash appear more than adequate for the foreseeable future in all producing countries. Due to seasonal fluctuation of consumption, production runs ahead of demand in the summer and fall months, causing a large portion of the industry's production to be warehoused for eventual shipment.

Long range outlook for the domestic industry is closely tied to the U. S. farm economy and the industry will prosper in response to demand for food production. The 1955 sales market was sharply competitive and the situation will probably be accentuated in 1956.

Five companies in the Permian Basin of southeastern New Mexico, one at Searles Lake, Calif., and another at Wendover, Utah, produced the bulk of U. S. potash in 1955. Two new companies are organizing to develop orebodies east of Carlsbad, N. M.

U. S. Potash Co., pioneer company in the Carlsbad district, is expanding production by 20% and modernizing its refining facilities. During 1955, USP installed an underground shaft pocket, complete surface crushing and loading plant at the No. 2 shaft and new Joy-type continuous miners designed for potash service with extensible conveyor belts.

This completely mechanized mining has 36-in. underground belt haulage that loads to existing underground rail transportation by Stamler automatic car moving and loading equipment. Removal of pillars provided substantial tonnage. Blast hole jumbos, Universal undercutters and underground rail equipment were added to existing facilities.

Potash Company of America's mining equipment and methods are being altered to use continuous miners and extensive conveyor belts to a greater degree. New continuous miners were designed and built by Potash Co., which plans to use them for recovery of 80% of production. When completed, the new belt haulage system will be more than seven miles long and will be one of the longest of its type. A 2,800-ton capacity ore bin will serve the belt underground.

Potash Production
(Short tons)

	Potassium salts (marketable)	Approx. K_2O equivalent
1943-47 average	1,637,831	881,928
1948	2,138,493	1,139,881
1949	2,056,609	1,118,395
1950	2,242,647	1,287,724
1951	2,474,870	1,420,323
1952	2,866,462	1,665,113
1953	3,266,429	1,911,891
1954	3,322,395	1,948,721
1955**	3,400,000	1,985,000

*U. S. Bureau of Mines figures
**E&MJ estimate

Potash Company of America, Ltd., a subsidiary, began a major development program 15 miles east of Saskatoon, Sask., during the year. Overburden there contains water-bearing sedimentaries and company decided to freeze the water-bearing zones in preparation for shaft sinking. Freeze holes were drilled around the shaft perimeter and refrigeration compressor equipment installed. The shaft section was frozen by circulating kerosene in the freeze holes to a depth of 3,000 ft. A large hoist was nearly erected; a smaller one designed and ordered (as was a new type of sinking stage); the shaft collar was poured and sinking commenced, all before the end of 1955.

International Minerals and Chemical Corp. improved and increased hoisting capacity with larger skips and faster automatic hoisting cycles. The potassium sulphate plant was modernized and capacity increased. Improvements in 1955 included a new office building of Southwestern architecture, use of Universal cutting machines to aid undercutting efficiency, and installation of operator-controlled magnetic-brake cars to provide greater speeds with heavier trips on downhill hauls.

Duval Sulphur and Potash Co. further increased dieselization underground, adding a diesel bulldozer and powderman's supply and equipment truck. Jumbo blast hole drills do mine production drilling and portable crushers are used in the mine to reduce ore size feeding onto conveyor belts from diesel- and trolley-powered shuttle cars. Mine is trackless, extending conveyors with development and production advances.

Southwest Potash Corp. began an expansion program in 1955 which will increase capacity by one-third and will be completed this month. Mechanization of operations continued during the year with addition of Universal cutting machines to replace shortwall undercutters. Four-wheel diesel tractors are being used underground.

National Potash Co., formed by Freeport Sulphur Co. and Pittsburgh Consolidation Coal Co., is developing and preparing to operate a sixth Carlsbad district potash installation. Company is sinking two 15-ft diameter shafts to an approximate depth of 1850 ft. Construction of plant auxiliary buildings, office buildings, a Santa Fe railroad extension, access highways and a water line were being completed at year-end. Limited production is anticipated during the first quarter of 1947.

Farm Chemical Resources Development Corp., combination of National Farmers Union, Kerr-McGee Industries, Inc., and Phillips Chemical Corp., is preparing development of a seventh potash property in the Permian Basin. First shaft, according to present plans, will handle men and material, although some ore will be hoisted to maintain a pilot plant which will operate while the second shaft is being sunk and the refinery built. Production target is set for 1959.

American Potash & Chemical Corp., which recovers potash at Trona, at Searles Lake, Calif., commenced operations in 1916. Largest producer outside of the Carlsbad area, the operation has shown no indication of increased annual output this year.

Bonneville, Ltd. Potash production from the famed Salduro Marsh near Wendover, Utah, is obtained by Bonneville. Method used is solar evaporation, followed by flotation. No capacity increases have been announced•

Mining Practice—Part I

Part I covers Underground Development and Stoping, including Ground Support. Part II in a forthcoming issue will cover the process from Loading on, including auxiliary services. Surface mining will also be covered.

Lloyd E. Antonides
Assistant Editor

PROGRESS IN MINING PRACTICE during the past year has not kept pace with the radical developments which burst forth in the first few years after World War II. But that experience has probably helped to lower the miner's resistance to change, so long a familiar situation. And now the large majority of mines report testing some scheme or equipment that is new to them. Although the trend is towards larger mines and higher rates of production, the rise in importance of rare metals and nuclear minerals makes small mines an important factor. Wider acceptance of recent developments is the keynote of this year's survey.

UNDERGROUND MINING

Shaft sinking is being successfully attacked on two sides—by mechanization and by better job planning. In the U. S. and Canada, operators are still concentrating on eliminating the tough job of hand-mucking with machines. Probably the most unusual is the Crydeman mucker. It works almost like a man's arm and hand, using seven air cylinders to actuate a clamshell bucket on a telescopic boom. Leitch Gold Mines, Beardmore, Ont. was the first to try it. It should also prove an answer to the problem of mechanical mucking in inclined shafts.

Another development is the Boland mucker successfully used in vertical shaft at Quemont. It uses a hydraulically operated clamshell bucket suspended on a cableway moved by two hoists. An orange-peel bucket can also be used. Use of tractor-loaders in inclined and vertical shaft bottoms was again noted in our survey.

In Africa emphasis on job planning must be given much credit for setting new world records. During the month of September master sinker Martin J. Tucker and his crew sunk the Monarch shaft of West Rand Consolidated Mines Ltd. 763 ft. The 20 x 12 ft. rectangular timber-lined shaft was hand lashed (mucked) and drilled with sinkers. Four 6-hour cycles were scheduled per day. Installation of shafting followed close by. Permanent head frame and hoist was used. Their work eclipsed by 96 ft the record made only a few months earlier at the circular concrete lined No. 1 shaft of Vaal Reefs Exploration and Mining Co., Ltd. Dovetailing, concentrating and standardizing work on tight schedule is reported a major factor in their success. These records are a far cry from the 100- to 200-ft per month of 50 years ago.

Doing more work with drilling schemes is helping to mechanize sinking operations. Large diameter holes drilled from surface are being used by more and more companies for varied uses—ventilation, fill, escape, et al. Calyx drills are the old standby for larger sizes and reamed churn drill holes for smaller. Leading this trend is a unique assembly consisting of roller-cone bits placed around bottom edge of rotating barrel which has cored several 6-ft diameter shafts.

Predrilling entire shaft with quarry rig, blasting in short lifts and mucking from surface with clamshell was cost cutter on shallow shaft in Ohio.

In normal shaft sinking, multiple drill jumbos are already well established as standard practice for major projects and newer units are promised. Use of large drill hole as blast relief and/or drainage to lower opening is fairly common.

Poured concrete linings using prefabricated forms are also frequently reported. Precast concrete dividers used in Africa are worthy of note. They are streamlined to lower resistance to air flow in the hot, ultra-deep mines.

Improved communications between bottom crew and hoistman or topside crew should not be overlooked as progress. Ozark-Mahoning at Rosiclare, Ill., suspended a microphone above mucking crew in shaft bottom so normal voice could reach hoistman over sound-powered telephone.

One unusual means of taking ore from underground is Algoma Ore Properties' plan for the Helen Mine. They are sinking a 4,900-ft, minus 22-deg, 12x12 incline from surface. An aerial tramway will carry ore in buckets directly from underground loading stations up incline and overland 1¼ mi. to mill. Inclined conveyors similarly used at Pend Orielle and White Pine have already been publicized.

Raising practice is advancing with the use of long drill holes to reduce costs. First stage of evolution is use of pilot hole for ventilation and blasting relief. This leads to use of complete predrilling of shorter raises. At one Canadian mine the pilot hole serves an added purpose. A hoist cable was run down through pilot hole and used to hoist and suspend a drilling platform which was lowered and unhooked before blasting.

Airleg machines are making inroads, although stopers still hold their own. Pioneer Gold mines boosted output 20% with conversion to lightweight stopers.

Dual openings are being used at Aunor Gold Mines to cut 70-deg raises from 1,000-ft level to surface without any other outlet. Main 7½x11- ft raise is to be used for exhaust ventilation and escape. Beneath it is 5x6- ft raise, to be used for fill pass, with 10-ft pillar between. At 60 ft intervals, inclined 5x5 ft cross overs allow muck to be bypassed from larger raise down to smaller when temporary bulkheads are placed. Raises are advanced alternately in 60-ft lifts. An air hoist with 2-man cage is installed in larger opening, as well as ladders.

Drifting and tunneling progress is marked by squeezing a complete cycle into one shift and by the adoption of equipment to load and transport entire round on one trainload without switching cars. Gaining popularity are: scrapers and ramps, extensible conveyors and cars with treadway along top edge for Sanford-Day's Gismo self-loading transport to run over. Larger size cars reduce switching too. Homestake switched from 20-cu ft end dump to 32-cu ft rocker dump cars and cut their cycle to one shift at the small expense of 6-in. larger opening. Calumet & Hecla uses an Eimco 40 conveyor mounted on a mine car chassis to better fill 7½-ton cars. They use Eimco 21 loaders.

On the drilling end, our survey reveals neither airlegs nor mobile jumbo-mounted drifters can claim an overwhelming advantage over the other.

Jumbos are more versatile than might be first imagined but logically find most successful application in the larger, level openings.

Warner Co. at Bellefonte, Pa. is using a rubber-tired jumbo on 18-deg slope. Barvue Mines uses a crawler mounted 4-machine unit on a minus 10% grade. At another property a small collapsible wheeled carriage that can be hoisted up raises for sublevel drifts is in service.

On the other hand, Pioneer Gold Mine, B. C., boosted output per man shift 10% by switching from hydraulic jumbo to air legs and Kerr-Addison increased the development rate from 180 to 325 ft per month by reducing cycle from 2 to 1 shift with 7½-ft airleg round rather than 8-ft column mounted drifter round.

In this work too, long holes are proving advantageous. An evolution similar to that found in raising seems to be the story—starting with a long over-size hole for blasting relief followed eventually by slashing to full size with long holes. Eagle-Picher in Wisconsin-Illinois blasts a long burn cut in sections to consistently get a longer round per set up. At Canadian Johns-Manville, slusher drifts are slashed to full size from a pilot drift with holes up to 60 ft long drilled by airleg and extension steel.

In conventional tunneling as in shaft sinking, new speed records have been set, this time in Scotland by Mitchell Construction Co. on St. Fillans Section of Hydro-Electric Board tunnel. In one week during October they cut 557 ft (6 ft more than old record in U. S.) of 8½-ft square tunnel using 5 Holman airlegs and Atlas Coromant 8 ft steel. Best cycle was 1½ hr. Best day gave 111 ft advance.

The Australians report a record too, on a hydro project in Snowy Mountains. They drove a 20-ft diameter tunnel 461 ft in one week. A report from Czechoslovakia says in one month 2,856 ft of 9.5x11.8-ft tunnel was driven using airlegs. Best day gave 106 ft.

In softer ground, machines are eating the rock and records in tunnels too. U. S. takes the lead here. The Robbins Tunnel Boring machine chewed a 24-ft 9-in. diamter opening 633 ft through sedimentary rock in 6 days of the first week in November. It's being used at the Oahe Dam, Pierre, S. D. Carbide teeth on rotating arms scrape grooves, pressure wheels follow to break down ridge, and scoops on arms dump muck onto conveyor. Up to 61 ft per shift were cut.

In cutting the crusher station at Levack, Inco used 175 holes, 10 to 49 ft long to open up a chamber 70 ft high 26 ft wide and 68 ft long. At a mine in New Jersey, pump station and sump cutting with long holes gave better roof arch and less loose. Long hole airleg equipment aids this trend.

STOPING

Stoping practice is marching ahead with wider adoption of improvements noted in past years. A long list of properties give similar comments—more TC bits, airlegs, long shell multiple drill jumbos and long holes in drilling; more slushers in ore handling; more rock bolts and classified mill tails for support; more dieselized trackless schemes for flat-lying orebodies and more sublevel longholing or blockcaving for dipping orebodies. In soft rock, such as potash and salt, the use of continuous miners and cutting machines continues to increase.

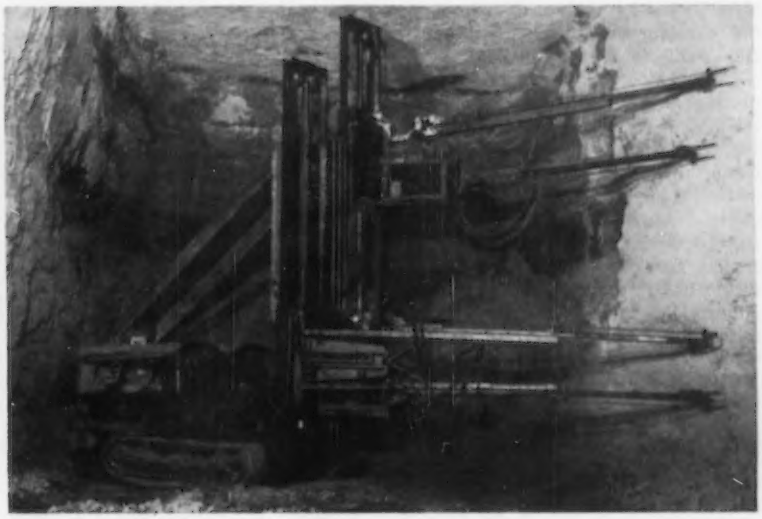
Open stope properties have taken trackless mining to heart. Eagle Picher in Oklahoma is extending their road system to allow dieselization of all areas. Early in the year a cement company in Kentucky put a huge Ingersoll-Rand self-contained, self-propelled jumbo to work. Two operators control 4 drifters on 19-ft chain feeds to cover a 40-ft high face.

Ballooning costs of shrinkage stoping were pierced in several instances with horizontal or vertical long holes. One mine cites the use of airlegs and sectional steel up to 45 ft. Rock bolting the sides keeps down dilution and bolting the back eliminates all props.

Cut and fill is having somewhat of a revival using hydraulically placed, classified mill tailings and rock bolts for support. Inco replaced square setting with this combination. Another property recovers bolts used in back on previous slice.

Sublevel stoping is booming along with immense blasts giving no trouble when fired with millisecond delays. One mine reported 306,000 lb fired in one blast with 15 ms delays. Gardner-Denver's large percussion drills and accessories developed in the past few years are noted as giving cost savings over diamond drills at several properties. But Inco uses a combination of diamond drills for longer holes and 4½-in. percussion drills for shorter ones on rings between levels 200 ft apart. Sigma Mines gained efficiency using Copco airlegs and 31½-ft flexible steel to ring drill floor and sill pillars. And in the Southern Illinois fluorspar district, Alcoa reports starting to use airlegs in subleveling—so far at half the cost of old drills.

An unusual use of sublevel stoping is reported at the Helen Mine, Algoma Ore Properties Ltd. Very similar to a huge glory hole, the scheme involves churn drilling from surface and bottom of old pit down to 300 ft, then longholing an additional 475 ft from sublevels to feed a centrally located crusher another 200 ft below. A 100-ft wide pillar is left across the middle of the 450-ft long by 60-to-180-ft wide wedge-shaped plan area to protect the crusher. Orebody dips at 70 deg. The ends are slotted and subs run around periphery and down center



ADOPTION of versatile airleg or multiple drill jumbo continues. Larger drifters and lightweight stopers have more limited use.

of wider half at 70- to 75-ft vertical intervals. In retreating from slots, vertical fans of horizontal to down holes as long as 125 ft are used. Maximum distance between ends of holes is 23 ft. Hole pattern is staggered in rings 5 ft apart. Footage reported was 124 ft per machine (1 man) shift. Diamond drills were used at first but now it's TC bits and 4-in. drifters.

Block caving practice has used concrete as major support material for sometime. Now two mines mentioned yieldable steel arch sets in scrams. They are mentioned as showing promise in eliminating need for "costly and dangerous replacement" or repair of other means of support including concrete. In the asbestos mines in Quebec, the airleg and sectional steel are used to undercut and bell out drawholes with fan patterns from drifts on undercut level.

Ultra-deep mines in South Africa, down to 9,876 ft at the Crown Mine, are reducing rock burst problems by careful, even advance of all faces in a straight line with no advance development and no remnants. The high temperature problem means more mechanization of work, lowering humidity and increasing fresh air supply. Water pressures reaching 2000 psi require much consideration but are not a major problem. Hoisting answers are found in bottom dump skips and speeds to 3,000 fpm. In U. S. Calumet & Hecla is working on burst problem.

DRILLING

Drilling is the first operation in mining and it seems to be the subject given first attention and having the most interest throughout our reports. It is a war on all fronts.

The basic battle of percussion versus rotary drilling for production goes on. In hard rock, percussion is still winning. Airlegs are acclaimed heros all over the map. Although the development of efficient large drifters and accessories, primarily Gardner-Denver's, has pushed diamond drilling back on the longhole line, Homestake tests indicate lower diamond drilling costs with "oriented" bits. And there is revived interest in the use of tungsten carbide tipped spade and finger type bits on rotary units for soft and medium hard rocks especially with auger steel. Both Chicago Pneumatic and Joy have introduced machines of this type.

Teaming up rotary and percussion action in one machine is the logical answer and research is proving that fact. It both crushes and shears the rock. As far as has been reported to *E&MJ*, the German Albo DK 7ES by Hausherr is the only drill on the market that uses the dual action.

Problems in drilling are complex, and considerable research is being expended on fundamentals of opening a hole in rock. While several universities and equipment companies are experimenting with underground drilling, oil well drilling groups are also sponsoring much basic work. Their findings will apply to smaller underground equipment as well. Information leaking out on the so-called sonic drills, toward which much of their work is directed, is not so revolutionary. They are being developed to get the motive force closer to the bit and eliminate the energy wasted in a long drill stem. Borg-Warner's drill uses the drilling mud to actuate the bit; Drilling Research's work is making use of electromagnetic transducers. They use conventional percussive bits and the frequency of blows is in the range of our present pneumatic machines (20-100 cps). But it should be mentioned that the transducer device research is using up to 1,400 cps. Ingersoll-Rand and a Belgian company have already introduced a "down-the-hole" pneumatic actuated unit for quarry work.

Clearing the cuttings from the hole is another salient. Water has the advantage of widest use now but air flushing has won on surface and is moving-in underground although more in coal than in hard rock. The need of trapping the dust means additional equipment, still a problem in spite of its being made more compact. So-called reverse flow. i.e., exhaust

through hollow drill steel, eliminates the collecting hood. Holman, LeRoi and Goodman drills are typical.

Getting back to underground straight percussive drilling and starting with the bit, there is no question that the tungsten carbide insert type has become the standard. Apparently there's no longer any controversy over whether the more costly bit is warranted in soft rocks. It has been generally accepted. Now the debate seems to be over whether to use the slip-on taper connection type or the screw-on threaded type or the integral bit starter type.

The weight of evidence is on the side of the detachable types probably for the same reason as with plain steel bits in the past—it's easier to handle a bit than the whole steel. But on shorter holes and light machines the integral bit is still widely advocated. And, of course, the increasing use of Copco's integral chisel bit, rectangular flexible steel is out of the controversy because "that's the way it comes."

Inco says the integral chisel bit, used on light machines in development work, is best—more footage at lower cost. They say the key to good results is no premature or over-sharpening. Golden Manitou uses the integral bit and light machines on development work, too. They retip it once. But they also use a larger size slip-on bit for cut holes and are testing the detachable bit for general use. For sublevel long holes they use a 2-in. screw-on type. An iron mine in Canada still likes to make their own carbide tipped steel. It gives them 50% lower costs. They are working on deeper inserts.

Testing of slip-on as against screw-on carbide bits is reported by Hollinger in Canada and M. A. Hanna in U. S. The problem is the skirt ringing-off. M. A. Hanna says a 3-deg taper on 1-in. steel proved satisfactory in eliminating costly thread failure but more testing is necessary.

Hollinger comments that their tests are indicating that reverse-buttress threaded bit gives best performance when properly put on with care—snug but not overtight. Bit sharpening angle of 113-deg is best—with sharper angle, bit screws on tighter causing some bit body failures. For the slip-on bit a sharper angle is possible—110 deg—which appears to give longer bit life and faster drilling. They found some significant results on experiments with the tapered-end steel. Best results came from: 1) machining a 12-deg taper and spiral rolling the rod; 2) hardening by heating to 1465 deg and quenching in oil to cool; 3) cleaning taper; 4) reheating to 800 deg and holding for one hour; and 5) cooling in 65-deg atmosphere out of drafts. Limited tests show spiral rolling increases tapered steel life 300%.

At the Greenwood Mine of Inland Steel the story is: in hard ore, use smaller bits with tapered socket instead of threaded connection.

Thompson Products Ltd. report they are working on a one-pass smaller insert TC bit with taper connection. It is used to destruction without resharpening and then thrown away. Tests so far are said to give good costs per foot.

Now that tungsten carbide bits are giving good life, drill steel is a problem. There is a wealth of literature on the subject and our survey finds many properties testing the various aspects of heat and mechanical treatment and of alloy composition. But operators do not seem to be giving it the attention that they give other elements in drilling.

The steel problem involves the means of connecting bit to steel and sections of steel to each other as well as receiving and transmitting the percussive blow. Eccentric loading of the steel at bit coupling or shank causes stress concentrations that cut life. The re-entrant angles of threads and collars and intercrystalline cracks do likewise. Corrosion accentuates it. Heat treating the ends of the steel in forging causes a soft transition area, the metallurgical notch, between the treated and untreated lenghts. To get longer life means more effort and control to smooth out the irregularities.

Here are a few comments: Hollinger—surface treatment by spiral rolling appears to increase taper shanked steel life 300%; Canadian Dept. of Mines—spiral rolling is more effective than shot peening; Climax—surface carburizing and shot peening combination is most promising; Calumet & Hecla—more careful control of heat treatment increased rod life 4 times; Canadian Johns-Manville—Copco's rope-thread connections on airleg sectional steel are working well; and from a number of mines—taper connections for bit and coupling saves money.

From Madsen Red Lake, A. F. Heather, mine superintendent, comes an interesting account with taper connections on integral carbide bit, collared ⅞-in. steel. A substantial reduction in drilling cost was achieved through multiple reuse of drill steel. If collar fails, it is re-used in a tappet type drill. If insert fails, end is ground to taper for slip-on bit. If rod breaks, ends are ground and then joined with taper coupling or used as mentioned above. He says no appreciable difference in drill speed was noted between collared or straight shank steel in tappet construction drills. Also mentioned is his view that in some cases use of tapered couplings gave faster penetration, perhaps because bushing action decreased rod whip.

In general the trend to airleg drilling is carrying with it a move to steel of smaller cross-section and stronger alloy.

At the motive end of the drilling string is the drill machine. Some mention of it has already been made. There is one comment that crops up time and time again—"good results in converting to airlegs." But the easily portable machines are having a difficult time knocking out the multiple long feed drifter drills on a mobile jumbo when there's plenty of room. And on longholes in sublevel stoping they are running into a tough adversary—the larger drifter. Yet Atlas Copco Pacific reports it has been possible to drill 157 ft with their airleg and ⅞-in. hexalloy Coromant longhole steel. Stopers are not out of the picture either. Several big producers use light weight units, in raise work especially.

In small hole rotary drilling, White Pine Copper reports experiments are beginning to look economical. A self-contained hydraulic driven unit powered by electricity was used. In passing, this is the mine that used 8-in. auger holes in place of a burn cut in drifting. A borax mine reports using electric augers for longholes. And Chicago Pneumatic's Rotauger is designed for long holes. But so far, application of all these rotary units is confined to the softer rocks. Not much is promised for their use on hard rock.

Decentralized air supply combats leakage and pressure drop at the Kiruna Mine in Sweden. They use wheeled jumbos with self-contained air compressor in a system described as trackless sublevel caving. This mine also found hot compressed air had advantages—drilling rate increased, air consumption is less in cubic feet because of lower specific gravity, and moisture condensation and freezing was reduced.

BLASTING

Blasting in breaking rock has not witnessed a revolution such as drilling has during the past decade, or even quarter century. Although accidents attributed to explosives have been greatly reduced, probably education has been the principal factor. The use of millisecond delays has been the most commonly reported advance again this year.

As for explosives themselves, the "make-it-yourself," low-cost compound of ammonium nitrate and carbon black has been publicized this year. Called Akremite, it has been accepted by a number of coal strip mines and some work with it is reported from the open pit iron and copper mines. But its use is probably limited to larger surface holes.

For underground work, Hercules King-Size extra length cartridges are reported a time saver at several properties. Nevada-Massachusetts reports using larger diameter sticks in small holes—1¼-in. rather than 1⅛-in. in 1½-in. holes. Alcoa's Flourspar Division says they are trying small, ⅞-in. diameter sticks in place of 1-in. but tests are not complete yet.

Two mines mentioned using explosive of higher strength in the bottom of long holes and lower strength in remainder, as an innovation at their properties. Loading adjacent holes with different velocity explosives and detonating simultaneously was said to give good fragmentation in one discussion.

Loading of holes should aim at getting the explosive tightly confined by completely filling the hole and by using good stemming. While there is no substitute for good tamping, easily broken paper wrappings have eliminated the need for slitting, and frequent mention of flexible plastic bags for quarry holes may lead to something more for underground use. So far, not much has been heard of a European practice of using compressed air to place sticks as well as loose powder into the hole. But for long holes plain flexible plastic hose with a wooden tip is reported at several mines and Granby Consolidated makes stronger loading sticks up to 30 ft long by inserting aluminum tubing (¾- or 1-in. I.D.) into plastic pipe with an easily renewed wood plug tip to fit the hole. Aluminum and plastic tubing alone are used as poles in the asbestos country too. Male and female screw joints are used.

Detonating the explosive is widely done with electric millisecond delay caps as is noted in many replies to our survey. Most common remark concerns their aid in better fragmentation—"they cut secondary blasting." Their ability to reduce vibration is exemplified in the huge single blasts fired. Powder consumption was low, 0.27 lb per ton, in one such underground blast.

For electric detonation White Pine Copper eliminates a maze of blasting power circuits with the use of a condenser-discharge hand-powered unit. Atlas Powder Co.'s machine of that type is worthy of note.

Hollinger reports a clever way to fire single electric caps. An electric cap lamp is modified for attaching the wirelegs so that the cap lamp battery can be used rather than a special battery or twist type exploder.

Non-electric blasting practitioners are reporting more use of a hot-and-faster-burning fuse with hand-pressed-on connectors to ignite standard safety fuse. The core is made of metal wire covered with thermite powder. Unaffected by water, it times the holes without the need to cut fuse to various lengths and requires "spitting" only one fuse. Triumph Mining Co., Idaho cites limited use of this Thermalite Ignitacord and connectors. Pend Orielle says they use it and so does Inland Steel at the Morris and Greenwood mines. Another company mentions its use and at the same time gives one reason for using fuse and cap—"it's safer in high sulfide ore." Inland Steel also mentions the use at Morris and Greenwood, of Quarrycord—a very fast burning, explosive core fuse really meant for igniting fuse and timing in open pit blockholding.

Non-electric and electric blasting practice at several properties makes use of detonating fuse, probably as insurance in blasting a long or decked (spaced) charge and in wet work. Only surface mines so far report using Pirmacord millisecond delays to time shots where detonating cord is used for branch and main lines.

One large Canadian producer stated it replaced regular detonating fuse with B line, a low cost brand by CIL, on secondary blasting in sublevel stoping.

In development, as mentioned above, the use of large holes in place of a burn cut is reported as new practice from several sources. And longer blast holes are increasing both in development and stoping.

Burden distance design was briefly but interestingly discussed by O. Anderson, Inspector of Mines, Queensland, Australia, in the British *Mine & Quarry Engineering* for January 1956. He repeats an earlier offered practical guide formula—$B = \sqrt{d\,L}$, where: B = burden in ft, d = diameter of hole in in., L = length of hole in ft—and says it has been borne out in a wide variety of formations. Strength and quantity of explosive takes care of some of the variation in rock but it applies both to surface and underground mining. To get better fragmentation to cut secondary blasting underground he says practice indicates that about two thirds of the value is often used.

There were a few comments in our survey about the argument of a few, widely spaced large diameter holes versus more, closer together, smaller diameter holes for getting better fragmentation . . but no actual results were given.

(*Continued on next page*)

On One Large Blast . . .

"In block extending from second level underground to surface, 1,131,000 gross tons of ore were detonated as a single blast in September. Results were very satisfactory. No damage was experienced by shock or concussion to either surface or underground installations. Data:

No. holes detonated	2,484
Powder	306,000 lb
No. millisecond delays	15
Power used	550v 60 cycle
No. series, 81 averaging 31 caps"	

GROUND SUPPORT

Ground support comments are sparked by mention of rock bolts. Large quantities are being used at mine after mine. They find wide application in development headings and in stopes. Expansion shell types seem to be preferred to the split-wedge. Lengths vary to fit the ground but 5- to 7-ft is the range of most.

Measuring proper tension is somewhat of a problem but two developments promise aid. USBM announced a compression pad of rubber sandwiched between two steel discs to be used as bearing plate. A calibrated collar is slipped over to measure the expansion of rubber and thereby indicate tension. The other is Ingersoll-Rand's new torsion-bar adjustable-torque impact wrench.

Steel mats, structurals and timber are used to spread support. Dished triangular plates give good bearing against irregular surfaces; guniting prevents slacking.

At U. S. Smelting, Refining and Mining Co. in Utah the remark is: "more roof bolting in stopes almost completely eliminates timber." Pioneer Gold says rock bolts and steel mats are cheaper and better than timber. Dished triangular plates are used on single bolts. They install 4-, 6- and 7-ft expansion shell types with impact wrenches.

New Mexico Consolidated, Hanover, N. M., uses ¾ in. by 5- and 6-ft expansion shell bolts especially where soft dike material is encountered. Sigma Mines is using bolts in stopes and drifts and replacing timber with them.

Inco used 5,000 to 6,000 bolts per month in 1955 and mentions their use in cut and fill stopes to replace square sets. In other openings they permit smaller cross sections. In scrams they eliminate damaged supports. Gunite is used when necessary. Their research has resulted in a stoper now being used to tighten a left-hand threaded bolt. Tests guarantee that minimum standards are maintained.

Golden Manitou uses expansion shells in roof, split-wedge in walls, of cut-fill stopes. In shaft, spalling and loose was cut down with 1-in.x5-ft. split-wedge bolts and ½-in. by 6-in. by 4-ft plate.

Dominion Wabana remarks on increased use of wedge type; Paymaster Consolidated on more 5- and 7-ft expansion-shell type; and Alcoa Fluorspar Division on roof bolts in shrinkage stopes and drifts. At Madsen Red Lake, rock bolts relieved a serious timber transport problem and increased working efficiency. White Pine Copper uses 4-ft bolts only, as required. And on down the list it goes. But Cal Uranium at Moab feels the silt and sandstone roof makes bolting expensive. They use a prebent 1-in. steel pin inserted into drill holes to make a stirrup for a timber cap.

On timber support, Inland Steel reports they treat all permanent timber with osmose salts.

CONCRETE support is having competition from yieldable arch in heavy ground.

Yieldable steel arch supports, still fairly new commercially, are stirring up interest and have several advocates. A U-shaped channel section and a bolted friction clamp is used. One producer says in heavy ground cost and service are the same as concrete, yet they are recoverable. Kennecott at Ruth, Nev., is using them in underground development. And M. A. Hanna is testing their use in scrams to eliminate costly and dangerous replacement of support but results are not available yet.

Classified mill tailings are continuing to be mentioned as a new support material in stopes where water is not an obstacle. They are hydraulically placed. Eldorado Mining's Beaverlodge operation is just one that commends the practice. Falconbridge Nickel is another.

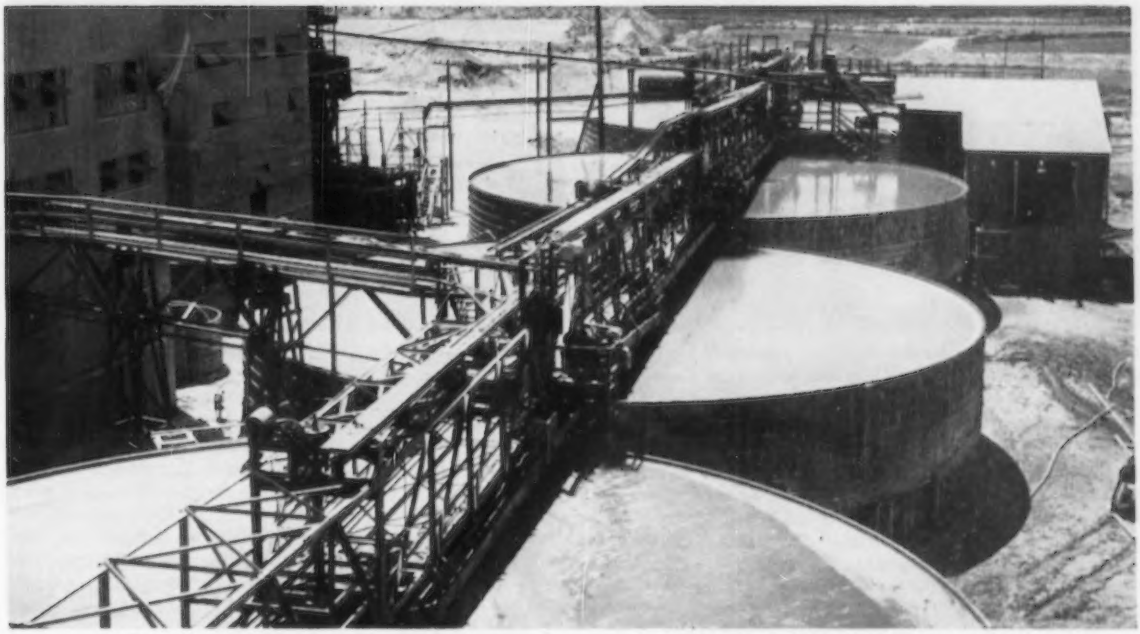
Cyclones are used to take out the slimes at Pioneer Gold Mines. They use two 12-in. DorrClones in open series. The 69% solid slurry with 4- to 6-in. per hour percolation rate is stored in 200 ton (dry weight) tanks and kept agitated with compressed air. When poured, more air and mechanical agitation is used and a 3-in. rubber line pipe conveys the sand down shaft. Distribution lines are 3- and 2-in. standard victaulic pipe. They have shown little wear after 75,000 tons have been passed.

Concrete is known to be a versatile and common support material at many operations but only one mentioned it as a new practice. That mine used air-placed concrete to seal a timbered drift through a caved area, then stopped the cave with mill-tails fill. Several mines mention the absence of any steel reinforcing or support in the concrete as a development. In the asbestos region of Quebec, there is frequent use of rock bolts to support heavy ground until concrete is placed. Where concrete is poured over steel sets, Asbestos Corp. Ltd. uses a stud driver to fasten steel plate to the structurals. After pouring, the stud heads are knocked off and plate easily removed. Surface or underground batch plants, pumps and pipe have been adopted where much concreting is done.

The recently reported use of rubber and plastic compound to seal underground openings for bulk storage, generated a comment that it may have an application similar to guniting—to stop air or moisture slack•

Part II of Survey of Practice will follow in the March issue.

Ore Dressing



SYNTHETIC flocculants were the outstanding development on the ore dressing scene with wide acceptance in the uranium mills to improve settling rates and thickener capacity, as at Vitro Uranium Co. above, or to reduce the number of thickeners required.

THE YEAR WAS HIGHLIGHTED by developments in uranium, the success of synthetic flocculants, a throw-away table deck, a successful year for one autogenous grinding unit and a great amount of new mill construction and planning. 1956 ought to be a good technology year for milling due to large capital investment.

Synthetic Flocculants. Perhaps the most significant development on the 1955 milling scene was the grass-fire-growth in the acceptance and the use of synthetic flocculants to improve thickening and filtering. Every mill development program and each new mill construction plan should have the proper testing of a synthetic flocculant near the head of the list.

Several reagent chemical companies are now producing these polyelectrolytes formerly known as soil conditioners. They have shown definite advantages when used alone or in combination with one or more of the natural flocculants.

James W. Franklin
Assistant Editor

In the case of one uranium leaching operation, five thickeners were replaced by a synthetic flocculant and one thickener; and at the same time the settling pond for thickener overflow was eliminated. Cost saving was $3,000 a day on $15 per day reagent cost.

At another leaching facility, filter rate per square foot of cloth area was raised from 300 lb to 5,600 lb per day by the proper addition of a synthetic.

At a third mill on the Plateau, size and capacity of the mill were doubled by the proper addition of a synthetic to feed going to thickeners and filters. In South Africa, mill men found that the synthetics worked best when coupled with one or more of the natural flocculants. This reagent is now being used in copper, barite, gold and sulphide programs. We stress the proper use of these synthetic materials because it has been found that unless synthetic flocculants are used in the prescribed manner they will not work properly; if at all.

An agglomerating table with an aluminum throw-away deck has been developed at Virginia-Carolina Chemical Corp., Nichols, Florida. Table top has been tested for more than three years under the direction of Charles Chapman, metallurgist at Nichols. Present indications are that the aluminum deck will last about three years on Florida pebble phosphate and eliminates need for a maintenance carpenter.

V-C has had 18 all-aluminum tables with disposable decks at their Homeland plant for over three years. Some decks were made in their shop and others in nearby fabricating shop. Decks are ¼ in. 61S-T6 alloy.

USING all aluminum construction, Virginia-Carolina Chemical Corp. developed an agglomerating table with a throw-away deck.

COMPLETION of Pronto's uranium mill made Canada world's second ranking producer (*E&MJ*, October 1955, p. 72).

Riffles are same alloy and their size was determined by trial and error. Now that the desired pattern has been determined, decks are produced in the shop, installed at the mill when needed and used until they wear out. Deck and riffles wear at the same rate, so it is not necessary to have on hand a carpenter making new riffles and repairing linoleum.

A commercial model, based upon the work at V-C, has been announced by Deister Concentrator Co. Without motor, all-aluminum model costs $1,400.

Uranium milling and precipitation methods were declassified late last fall. In a thorough disclosure of the Vitro leaching technique, the Beaverlodge flowsheet and the 20 odd papers on uranium milling techniques at the Geneva Atoms for Peace Conference, uranium technology received the most extensive coverage of any milling problem in the past year.

From the declassification of uranium processing came details on the use of the synthetic flocculants, countercurrent decantation, solvent extraction, and ion exchange. The Geneva papers were summarized here last fall so no attempt will be made to retell the story. A bibliography of the Geneva papers on thorium and uranium milling is available from *E&MJ*.

Vitro pointed out that proper blending, roasting to yield more uranium or to make slime settling easier, blending of roast and non roast ores, countercurrent decantation in thickness with a synthetic flocculant, precoating drum filters with diatoms and phosphate reduction precipitation were the keys to treating mixed Plateau ores.

Autogenous grinding. Jones & Laughlin Steel Corp. has been testing and breaking in a 17-ft by 5-ft Aerofall mill for the past year and published reports indicate that J&L is quite pleased with the results. Mill has 600-hp drive and 600-hp fan system. Grinding iron ore (23% Fe magnetite and black hematite in feldspar) from 6 in. to minus 8 mesh, mill has treated 575,000 tons to date. Liner wear was reported to be 0.07 lb per ton feed.

Harlowe Hardinge, Hardinge Co., pointed out the many pitfalls and potentials of autogenous mills. His point, based upon 50 years of experience, was that the limiting factor is characteristic limit of self-grinding of the components in the ore.

Copperhill's ball mill continues to function as one of the most efficient grinding units in the country. Latest attempt to make it a better mill was to be reported on at the AIME February meeting, but they asked for more time to work on the method before making the results known.

Impact crushers are being tested and used in the Asbestos country. Crushers are of German design and are being used as secondary crushers. One attempt to use an impact crusher as primary in the mine failed and the unit has been removed.

In Germany, considerable attention was focused on the impact units. Work published in Canada, U. S. and Germany by Dr. Edgar Puffe showed just where and when the impact principle can be used to advantage. Brittle material, cemented ore or ore with good cleavage make the best feed for impact working.

Dry concentration employing supersonic vibration was introduced by R. G. Osborne Laboratories Inc. A pilot plant was tested at 2 to 5 tons per hour feed rate on minus 8 mesh ore. Recoveries were low, ranging from 55% to 75% with the preconcentrate treated on wet tables for final cleanup.

Wet cyclones continued to draw new advocates as a desliming unit and as a sizing unit in conjunction with other classifiers. Don't expect cyclones to be cheaper to operate than conventional classifiers due to high capital and pump operating costs.

Submerged filter received notice in the uranium country. One mill reported using a totally submerged filter in place of a thickener. Filter takes feed ahead of the final cake filter and makes a fast solid-liquid separation, discharging a thickened pulp to the cake filter.

Copper leaching and flotation process mentioned by Nathaniel Arbiter, Columbia University, in last year's review has not been published as yet. As soon as the patent situation is cleared up it will be released.

With the new emphasis on oxidized copper we can expect to see more milling and economic data released on that subject. With the completion of the taconite plants we will get good coverage on the milling technique and tremendous abrasion problems envolved in handling volume of ore required to make a taconite plant economic. Any piece of equipment that has been "taconite tested" and passed, can be relied upon to give long wear life

Major Mill Construction Completed or Announced in 1955

IN ADDITION to the many facilities where capacity was increased or where intention to increase capacity was announced, the below stated mills were completed, announced or started this past year. No attempt has been made to list each and every mill; only the major ones are included.

While uranium, lithium and thorium held the spotlight during the year, copper was still king. More new milling facilities for copper were completed than for any other commodity. Although copper provided the most mills, taconite iron ore received the most dollar investment. Taconite capital investment in the state of Minnesota will exceed the combined total of all present capital investment in that state; including farms, homes and industry.

In the coming year, copper will still lead the way in number of major mill erections. Many new mills and mill expansions will be announced. Attention in Chile, Peru and Western U. S. will be focused on oxidized copper. If all the mills now announced are on stream by 1956, the world capacity at that time will be in excess of 3-million tons annually.

With the present and projected price of copper, considerable money will be spent to treat large oxidized deposits or to get more copper from the oxide remaining in mill tails. Processes will revolve around float-leach and/or leach-float techniques. Look for an extensive survey of the oxidized copper picture to be published in 1956, in line with the present interest in the chrysocollas.

MILLS COMPLETED

COPPER

Atas Consolidated Mining & Development Corp. Toledo, Philippines
White Pine & Copper Range Co., White Pine, Michigan
Campbell Chibougamau, Quebec
San Manuel Copper Corp., Arizona
Chibuluma Mines, Ltd., Rhodesia
Compania Comercial y Minera Sali Hochschild, Capiapo, Chile

LEAD-ZINC

Bleiberger Bergwerks, Gailitz, Austria Gyongyosoroszi, Hungary

TUNGSTEN-LEAD

Minarbipa, S. R. L., Jachal, Argentina

URANIUM

Pronto Uranium Mines, Algoma, Ontario
Gunnar Mines Lt., Saskatchewan
Metalmina, S. R. L. Buenos Aires, Argentina
Anaconda Co., Bluewater, New Mexico
Kerr-McGee Oil, New Mexico

IRON ORE

Reserve Mining Co., Silver Bay, Minnesota
Marmoraton Mining Co., Marmora, Ontario
Rhude & Fryberger, Minnesota

GOLD

Masara Gold Mines, Davao, Philippines
Gold Mines of Kalgoorlie Ltd., Australia
Illapel, Illapel, Chile
Samar Mining Co., Davao, Philippines

OTHERS

Quebec Lithium Corp., LaCorne Twp., Quebec
Lithium Corp. of America, Bessemer City, North Carolina
Williamson Diamond Mines, Tanganyika
American Lithium Chemicals Corp., San Antonia, Texas
Asbestos Corp., Back Lake, Quebec
Marsman Quicksilver Mines, Philippines

STARTED OR ANNOUNCED

COPPER

Southern Peru Copper, Toquelpala, Peru
Mauricio Hochschild, Mantos Blancos, Chile
Anglo-American, Kilembe, Uganda
Anaconda Co., Africana, Chile
Chewalah Copper Co., Washington
American Metal Co., New Brunswick
Campania Minera Tamaya, Las Chivas, Chile
Israel Government, Elath, Israel
Compania Cupifera Sagasca, Iquique, Chile
Mpanda Mines, Tanganyika
Macalder Nyanza Mines, Kenya
Maritimes Mining, Tilt Cove, Newfoundland
Granduc Mines, Canam Copper, Geco Mines, Willroy Mines and Consolidated Basin Mines, all in Canada
Cia Minera Chapi, S. A., Chapi, Peru
Chibuluma Mines, Northern Rhodesia
Mindanoa Mother Lode, Philippines
Kennecott Copper Co., Ray, Arizona
Chile Copper Co., Santiago, Chile
Anaconda Co., Chuquicamata, Chile

IRON ORE

Inland Steel, Steep Rock, Ontario
International Oil & Metals Corp., Vancouver Island, British Columbia
Cleveland Cliffs, Eagle Mills, Michigan
Erie Mining Co., Minnesota

URANIUM

Uranium Ore Reduction, Riverton, Wyoming
Verdi Development, Mojave, California
Algom Uranium Mines, Blind River, Ontario
Cons. Denison, Blind River, Ontario
Rare Metals Corp., Tuba City, Arizona
Continental Uranium, Moab, Utah
Hartebeestfontein, Union of South Africa

OTHERS

Republic Steel Co., Oaxaca, Mexico (Rutile)
Mitsuibishi Metal Mining, Thailand (Tin)
Carey-Canadian Mines, Quebec (Asbestos)
Otanmakei Corp., Finland (Vanadium)
International Minerals & Chemical Corp., Havelock, Ontario (Syenite)
Molybdenum Corp. of America, Oka, Quebec
Compania de Bombona. S. A., Colombia
Pacific Coast Borax, Boron, California
Arizona Golconda Metals, Arizona
American Gilsonite Co., Gonanza, Utah
Northern Mining Co., Greenland (Lead)

New Patents Published in 1955

THE FOLLOWING are some of the patents released during the past year relating to milling and milling equipment. *Chemical Engineering and Mining Review*, published by the Tait Publishing Co., 349 Collins St., Melbourne, Australia, furnished the Australian data. Patent numbers of English releases are from *Mining Magazine*, published by Mining Publications Ltd., Salisbury House, London, E. C. 2.

Sherritt Gordon's hydrometallurgy process, the Chemico process, a process for electrowinning of lead from galena and several flotation patents featured the methods releases. In the equipment design field, several electrostatic separators, magnetic separators, heavy meadia units, a new flotation cell, several filters and American Cynamid's dewatering agent were among the many new items announced

AUSTRALIA

No. 144,236	Conveyor belt improvement
No. 145,330	Conveyor belt
No. 141,121	Flotation. Koppers process

ENGLAND

15,619 of 1951, No. 723,775	Mineral cleaning plant
16,020 of 1951, No. 724,138	KCl flotation
23,195 of 1952, No. 722,373	Sherritt Gordon hydrometallurgy
23,952 of 1952, No. 723,477	Electrostatic separator
24,432 of 1952, No. 724,760	Ore concentrator
1,643 of 1952, No. 726,535	Electrowinning of lead
1,644 of 1952, No. 726,536	Same
28,140 of 1952, No. 726,197	Heated screen
3,129 of 1953, No. 725,555	Dow titanium production
8,090 of 1953, No. 725,715	Erie Mining pelletizing
9,361 of 1953, No. 725,460	American Cyanamid dewatering agent
36,214 of 1953, No. 726,530	Zinc smelting
10,384 of 1951, No. 731,527	Sulphide roasting
19,250 of 1952, No. 731,282	Sylvite flotation
958 of 1953, No. 730,908	Precipitation of uranium
5,598 of 1953, No. 731,987	Cobalt-nickel separation
8,304 of 1953, No. 731,747	Agglomerating titanium ore
13,471 of 1952, No. 728,962	Heavy media separation
20,492 of 1952, No. 729,934	Electrostatic separator
18,730 of 1953, No. 729,697	Gravity concentration
29,090 of 1950, No. 727,315	Pellet binding compound
1,781 of 1952, No. 727,582	Gold by ion-exchange
19,368 of 1952, No. 719,843	Magnetic separator

UNITED STATES

No. 2,688,529	Uranium fluoride production
No. 2,688,530	Same
No. 2,689,041	KCl beneficiation
No. 2,689,783	Sulphur production
No. 2,690,376	Uranium from ore
No. 2,688,196	Dryer
No. 2,688,807	Conveyor-dryer
No. 2,688,406	Filter
No. 2,688,403	Magnetic separator
No. 2,688,405	Centrifugal
No. 2,688,437	Same
No. 2,689,646	Flotation cell
No. 2,690,261	Western Machine heavy media unit
No. 2,690,262	American Cyanamid heavy media
No. 2,696,309	Drum filter
No. 2,696,916	Same
No. 2,696,302	Screen
No. 2,696,298	Deister Concentrator classifier
No. 2,699,898	Air-swept mill
No. 2,699,900	Traylor gyratory crusher
No. 2,701,753	Solvent extraction, continuous
No. 2,701,240	Diatomaceous filter aid
No. 2,700,466	Western Machine drum separator
No. 2,701,056	Cyclone separator
No. 2,701,058	Heavy media separator
No. 2,702,126	Filter press plate
No. 2,703,177	Disk filter
No. 2,702,683	Vibrating trommel
No. 2,702,634	Allis-Chalmers screen mechanism
No. 2,703,676	Sharples discharge for centrifugal
No. 2,702,630	Sharples particle classification
No. 2,702,632	Same
No. 2,701,901	Beneficiation of potash ore
No. 2,709,521	Screening concentrator
No. 2,710,149	Hammer mill screen changer
No. 2,709,003	Ore concentrator
No. 2,712,416	Centrifugal grinding machine
No. 2,710,693	Continuous filter construction
No. 2,711,251	Vacuum filter
No. 2,712,387	Drum filter
No. 2,711,250	Trommel
No. 2,711,854	Centrifugal
No. 2,710,691	Pickands, Mather's heavy media
No. 2,711,249	Drum magnetic separator
No. 2,711,958	Chemico hydrometallurgy

on what was heretofore considered a good-size milling program. Hourly feed rates of some of the taconite projects are more than adequate for a daily tonnage through some of our medium-size mills.

In 1956, milling will take a new stride forward in production and technique. Developments that would come in time, will come in short order; due to the tremendous sums of money being invested in the metal and mineral market at this time. Concentrated dollar effort directed toward treating lower grade ores and getting more yield out of our remaining high grade ore, cannot but help intensify the progress of ore dressing•

Extractive Metallurgy

THE PAST YEAR marked the 400th anniversary of the death of Georgius Agricola, the author of De Re Metallica, on November 21, 1955. Metallurgists and mining engineers alike are familiar with this monumental book through the translation made by Herbert Hoover and Mrs. Hoover. In the introduction to their translation the Hoovers comment on Agricola's contribution to the science of mining and metallurgy as follows, "while he describes, for the first time, scores of methods and processes, no one would contend that they were discoveries or inventions of his own. They represent the accumulation of generations of experience and knowledge; but by him they were, for the first time, to receive detailed and intelligent exposition. Until Schlüter's work nearly two centuries later, it was not excelled.

". . . he was the first to found any of the natural sciences upon research and observation."

One cannot help but contrast a time, when De Re Metallica was the best source of technical knowledge for almost two hundred years, with the present, when we find new processes, new equipment and new experimental results on mining and metallurgy presented every year in a multitude of publications. Not all of these modern articles will match Agricola for permanence of value or for "detailed and intelligent exposition"; but they are a measure of the rapidity of our progress.

Sometimes the new developments turn out to be greatly improved versions of old processes. As an example, during the past year there have been a number of articles on zone refining by W. G. Pfann and other workers at the Bell Telephone Laboratories. The method consists essentially of moving a zone of liquid metal through an ingot; impurities more soluble in the liquid than in the solid are swept to one end and can be cropped off. Zone refining has been particularly successful in preparing high purity germanium and silicon for use in transistors. Recent publications also describe the refining of gallium, antimony, tin, titanium and other metals by the process.

A. W. Schlechten
Professor of Metallurgical Engineering, Missouri School of Mines and Metallurgy, Rolla, Missouri

In considering the principle of concentrating the impurities in a liquid phase, the metallurgist is reminded of the obsolete Pattinson Process for removing silver and bismuth from lead bullion. Increasingly pure crystals of lead were separated in successive crystallizations from the liquid bullion which retained most of the impurities.

It seems possible that the new techniques might make it possible to revive a variation of the Pattinson Process. Pfann has described a continuous zone refining apparatus which utilizes a molten metal feed going into refining columns with external moving heaters. The sequence of heating and cooling produces a reflux refining action which yields a high purity product.

Evidently the handling of large tonnages by zone refining is not too formidable as Battelle is investigating it as a means of purifying sea water.

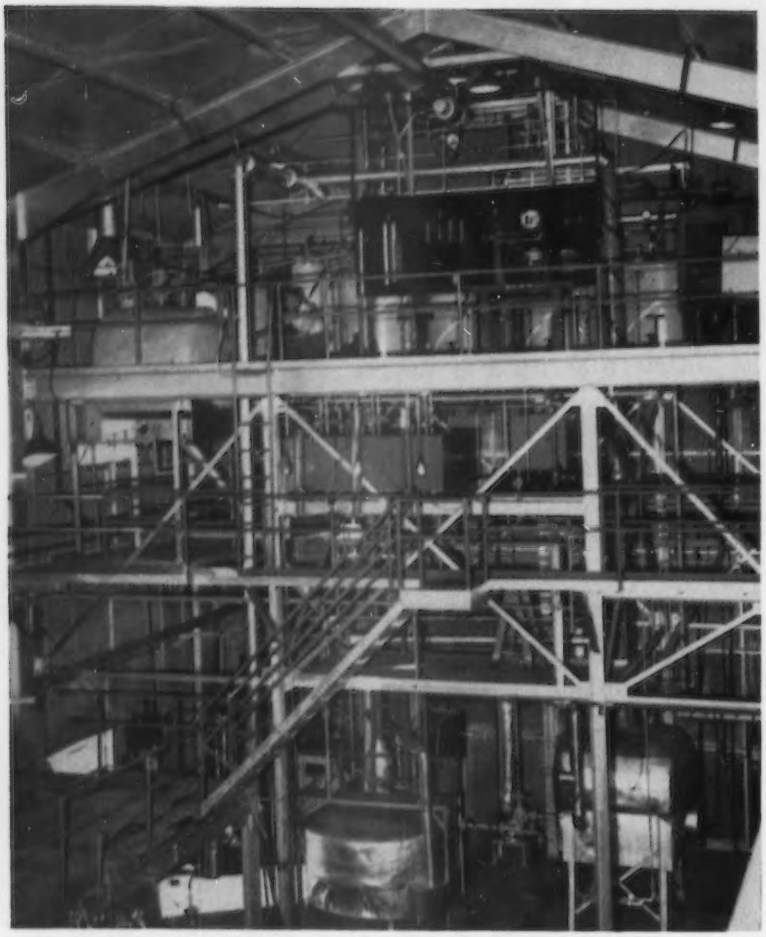
"Chemical journals tell us that the subject of inorganic chemistry is receiving the greatest attention that it has had in many years. Developments are rapid particularly in the field of the less common metals and their compounds. Let us hope that our mining and metallurgical companies will climb on the band wagon in time to join the procession. We don't expect to see any decline in the use of the common metals, but with an increasing population and a growing technology the demands of the future will be different than in the past."

Refining Titanium. It was mentioned that zone refining has been used for titanium. These experiments by workers at Westinghouse utilized induction heating on square or fluted titanium ingots held vertically in an inert atmosphere. Induction heating melted the interior of the bar but not the edges, so it was not necessary to use a container for the metal. Iron contamination was reduced, but presumably the process had no effect on the two worst offenders, oxygen and nitrogen.

Separation of titanium from oxygen by vacuum sublimation has been achieved by A. B. Osborn. Samples containing 2, 6 and 16 weight percent oxygen were heated in vacuum at 1,500 to 1,600 deg C and the vapor condensed. The condensate contained 0.6, 1.0 and 5.0% oxygen respectively. Thus some purification was obtained, but the process required 1,600 kwh per pound of titanium, which is definitely not economic.

At the Fulmer Institute a number of patents have been obtained on procedures for refining titanium. The basic idea seems to be to react impure titanium with a halide to form a lower valence titanium halide which is then disproportionated or decomposed to yield a pure titanium product. It will be remembered that Dr. Gross of the Fulmer Instiute has developed an aluminum refining process which works in the same general fashion with the formation of aluminum monochloride as the intermediate step. It has been stated that silicon can be purified by a comparable process.

Electrolytic refining of titanium using a fused chloride bath shows considerable promise and does not present as many problems as electrowinning of the metal. Oxygen content of the soluble anode reports as titanium oxide particles in the bath. Of course precautions must be taken to prevent mechanical carry over of the oxide to the cathode product, and the usual problems of inert atmosphere and removal of the cathode must be



$TiCl_4$ REFINING SECTION at the Electrometallurgical Experiment Station, operated by the U. S. Bureau of Mines at Boulder City, Nev., seeks new low-cost methods.

solved, but it may become a commercial process.

Refining by the deBoer iodide decomposition process has been described in great detail in a new book on zirconium by Lustman and Herze. Although they refer particularly to the large scale work done for the AEC on zirconium, most of the information applies equally well to titanium.

Refining of Lead. A study of the debismuthizing of lead by Davey makes use of diagrams of the quarternary systems Ca-Mg-Bi-Pb and K-Mg-Bi-Pb to show the mechanisms by which the bismuth is removed and to predict reagent additions necessary to achieve desired bismuth levels. Davey indicates that K-Mg additions will produce lower Bi contents in the refined lead than can be obtained with Ca-Mg additions. Other pyrometallurgical methods for debismuthizing are discussed in the same article. The commercial use of K-Mg for debismuthizing by the Penarroya Co. is the subject of a paper by J. Iche.

Refining of bismuth by distillation and chlorination has been proposed by Rogers and Campbell. They found that chlorination effectively reduced Pb, Cu and Fe contents but not Ag. On the other hand, distillation of the bismuth left behind the Ag, Cu and Fe, but the Pb carried over and more Fe was picked up from the retort. The authors proposed a combination of the two methods to achieve a good purification.

In an interesting discussion of the paper, Professor MacEwan suggested that it might be easier to eliminate the Ag by Zn additions and that any residual zinc would be eliminated in subsequent chlorination, thus vacuum distillation would be superfluous.

Additional discussion by O. W. Ellis did not seem particularly apropos of the original paper but did offer worthwhile information on the chlorination temperatures of Cu, Fe, Co and Ni as well as their sulphides and oxides and the volatilization temperatures of those chlorides.

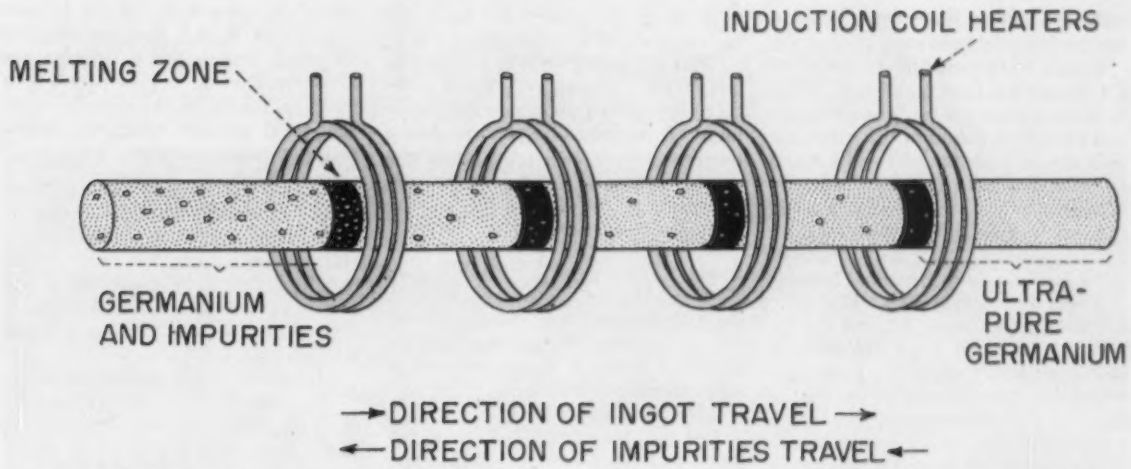
Chlorination of Ores. Discussions of chlorination inevitably lead to the question of chlorinating ilmenite. Dr. W. J. Kroll in a recent German article states that the real problem of titanium production is the supply of high purity $TiCl_4$. He points out that the supply of rutile is so limited, economic treatment of ilmenite is a necessity. Various approaches are discussed and considerable information is given on the possible procedures for smelting ilmenite to produce a high Ti-content slag which can be chlorinated.

Roberson and Banning have reported the results of smelting ilmenite obtained as a byproduct from monazite sand concentration. The ilmenite with an equal weight of wood chips and sometimes a coke addition was smelted in an electric furnace. Slags averaging 75 to 83% TiO_2 were obtained. These slags plus carbon were chlorinated to give an acceptable grade of comercial $TiCl_4$. Chlorination of the slag without addition of carbon selectively removed the iron so that a 94% TiO_2 residue was obtained.

Rowe and Opie have reviewed the same subject in a more general way. They show how increased temperature of chlorination will increase reaction rates but will also increase the total volume of the gases so that the $TiCl_4$ concentration is reduced. Chlorination of TiN and TiC are strongly exothermic, but TiO_2 plus C mixtures can be chlorinated without addition of heat, in fluid bed reactors over 20 in. in diameter. The main problem is in condensing and collecting the $TiCl_4$. Carry over of dust, plugging of lines by $FeCl_3$, and corrosion all complicate the process. The Authors state that there is a great need for efficient, low cost chlorination methods.

Canadian Patent 511,904 to Trasmus, claims a process whereby titaniferous ores plus $CaCl_2$ are heated to 1,000 to 1,200 deg F under vacuum to volatilize iron chloride. Patents assigned to duPont describe fluidized bed chlorination of titanium compounds or slag wherein portions of the reacting mass are withdrawn and leached to keep down the concentration of alkali and alkaline earth chlorides.

Distillation is the usually accepted method of refining $TiCl_4$, but a recent patent to National Lead describes an



ZONE REFINING. Impurities more soluble in liquid than in solid germanium are swept to one end and cropped off.

electrolytic process in which the $TiCl_4$ is refined in a fused bath of alkali chloride. Insoluble electrodes are used and the purified $TiCl_4$ is evolved from the anode.

R. V. Horrigan has described how high purity $ZrCl_4$ can be obtained by heating anhydrous fused mixtures of $ZrCl_4$-NaCl-KCl.

Production of Titanium and Zirconium. Actual production of titanium metal has been discussed in a multitude of articles without bringing to light much new information. One interesting patent isued to Imperial Chemicals describes the reduction of $TiCl_4$ with sodium above 200 deg C but below the melting point of NaCl. The product is formed in an "agitated nonadherent particulate bed." This undoubtedly explains the mode of formation of the granular titanium product sold by I.C.I. which differs from the customary sponge.

Production methods for zirconium as developed by the U. S. Bureau of Mines have been given considerable publicity. Interest in the subject is rather keen at present, because the AEC has requested bids on a new plant to increase production facilities by 400,000 lb per year, which would be twice the capacity of the present plant operated by the Carborundum Metals Co.

Detailed descriptions of the production methods are given in two new books, one by G. L. Miller and one by Lustman and Herze. Variations and modifications of the standard Kroll process are described in an article by Gilbert and Morrison. The most significant change has been the elimination of the step where the $ZrCl_4$ was sublimed in a hydrogen atmosphere to purify it. It was found that it is sufficient to heat the crude $ZrCl_4$ at 200 deg C under reduced pressure, using several changes of helium, previous to the reduction step.

Block and Abraham have written concerning recent innovations in the control and operation of zirconium furnaces.

Pressure Leaching and Reduction. Currently popular, is the subject of pressure leaching and reduction, discussed in a number of authoritative articles during the past year. R. D. Macdonald has written concerning the demands on equipment, batch versus continuous leaching, and has listed the procedures at the commercial plants that have been built. Forward and Mackiw have described the chemistry of ammonia pressure leaching of Cu-Ni-Co ores. Forward and Halpern have performed experiments on acid pressure leaching of uranium ores, and found that most ores when leached at 130 deg C, under 10 psi partial pressure of oxygen gave 90 to 95% extraction in 4 to 6 hours. The authors claim that elimination of reagent costs (only air or oxygen are needed for sulphide ores), short retention times and high recoveries would warrant use of the process on certain refractory ores.

Commercial pressure leaching of uranium has been described by Mancantelli and Woodward under the rather receptive title of, "Use of Autoclaves and Flash Heat Exchangers at Beaverlodge." They point out that except for autoclaves and heat exchangers, their plant is very similar to a gold leaching plant. Evidently the process is working quite well with very little trouble except for some pitting of steel autoclaves at the liquid line.

Pressure leaching of ilmenite using dilute H_2SO_4 at 200 deg C and 50 psig has been reported by Whalley and Downes. Downes and Bruce have written concerning the recovery of elemental sulphur from pyrite and pyrrhotite. Controlled oxidation of an aqueous suspension of finely ground pyrrhotite in an autoclave at 120 deg C and 150 psig of oxygen yields sulphur and Fe_2O_3 which are easily separated. The molten sulphur tends to occlude some sulphides and some sulphides go into solution; for example, up to 80% of the Ni will be in solution as a sulphate. Pyrite must be decomposed to FeS in absence of air before the leaching step, as pyrite will oxidize to iron sulphate and sulphuric acid if leached directly.

Sherritt Gordon's pressure leaching plant at Fort Saskatchewan reached rated capacity in 1955 according to Sydney Nashner. His article describes the operation and shows a diagram of a continuous four-compartment autoclave. Copper is precipitated from the solutions as a CuS-Cu_2S solid. Nickel is precipitated with H_2 at 350 to 400 deg F and at total presures of 250 to 500 psig and is recovered in powder form. Cobalt is precipitated as a mixed Co-Ni sulphide, but the Co-Ni separation is not described; Nashner states that a satisfactory economic method is being developed.

Necessity of pilot plant experimentation for pressure processes is emphasized by Nashner. He states that the scale-up to commercial size from pilot plant can be predicted very well in the case of chemical results and corrosion, but even pilot plant results do not give

sufficient data to predict physical and mechanical problems such as erosion

Details of the selective reduction of Cu, Ni and Co from aqueous solutions have been reported by Schaufelberger and Roy; they point out the particular difficulty of separating Ni and Co and list many of the methods that have been used previously. Copper is easily reduced from sulphate solutions by hydrogen under pressure, and the authors feel that such a method has advantages over electrolysis. However, selective reduction of Ni and Co by hydrogen requires close pH control, and to get both metals in a pure state would necessitate making a Ni-Co middling for retreatment.

In a discussion of the paper, M. H. Caron looks with some skepticism on the advantages both of pressure leaching and pressure reduction. He states that it would be very difficult to obtain Ni from a high Co solution by hydrogen reduction and that corrosion problems will be very severe.

In a paper of his own, Caron describes the ammonia leaching of nickel sulphide, tracing development of the process and his work on ammonia-ammonium carbonate processes. He refers to U. S. Patent 2,556,215 to the International Nickel Co. for treatment of a very low grade nickeliferous pyrrhotite by first leaching the Ni and then producing high-grade iron oxide pellets. The method consists of suspension roasting, controlled selective reduction of the calcine, Ni extraction by counter current leaching with NH_3-$(NH_4)_2CO_3$ solution, recovery of the Ni as basic nickel carbonate, and return of the NH_3 and CO_2 to the process.

Caron feels that although pressure processes permit direct production of metal powders, elimination of roasting, and production of $(NH_4)_2SO_4$, the disadvantages of pressure apparatus are very serious especially for lower grade materials.

Aluminum. Of interest to most nonferrous metallurgists was the entry of the Anaconda Co. into the aluminum business with a new reduction plant near Glacier Park. The cell design, developed by a French concern, features a Soderberg-type electrode with vertical studs. Cell gases are burned and conducted to cyclones and scrubbing towers being exhausted to the atmosphere. Cells operate at 100,000 amp and the two pot lines will produce 60,000 tons of Al per year.

It has been stated in the press that Anaconda is taking definite steps to develop a process for recovery of alumina from clays to be found in the eastern part of Washington.

With more companies operating aluminum reduction plants, we can probably expect more papers on the metallurgy of the reduction process. Along this line, von Zeerleder has traced the development of present methods and tells of experiments with other processes. For example, aluminum sulphide can be electrolyzed at temperatures of 850 deg C which is 100 deg less than for Al_2O_3. Solubility of the sulphide in the bath is greater and there would be no consumption of the anode. Chief drawback would be the preparation of pure aluminum sulfide and the disposal of the sulphur fumes.

Attempts have been made to revive the electrolysis of aluminum chloride. An $AlCl_3$-KCl-NaCl bath can be operated at 170 to 180 deg C with Al deposited as a solid at the cathode. This and other chloride processes have been uneconomic in competition with the Hall process, but there is ample room for improving present methods.

Lead and Zinc. In an article on the Rönnskär Smelter of the Boliden Co., O. Herneryd mentions a new lead sinter feed preparation plant now under construction. Return sinter will go through three successive pelletizing drums where they will be covered with concentric layers of lead dust, lime and lead concentrates. These pellets will go to the sintering machine and will make it possible to sinter a charge as high as 80% Pb as compared to the usual limit of 45 to 50% lead.

New facilities for sinter charge preparation at Bunker Hill have been completed at a cost of $2.5-million. Materials are crushed and then ground in dry rod mills. A bedding plant large enough to hold four 900-ton piles permits proper proportioning of sulphur and lead as well as addition of fluxes. The resulting mix is pelletized, and the pellets dried before being fed to sintering machines.

Fuming of zinc from lead blast furnace slags has been studied by Bell, Turner and Peters to determine the thermodynamic activity of the ZnO and assess the probable effect of fuel composition, oxygen enrichment and air preheating on capacity. The study indicates the possibility of substantial improvements in operation.

Fuming of zinc and lead from copper reverb slags according to Mast and Kent, is limited to slags not much over 40% SiO_2. High SiO_2 slags are difficult to blow; the furnace vibrates and the slag threatens to freeze. Converter slags may be added to restore fluidity, but if this cure fails and the furnace does freeze, 4 to 5 days are required to break it out. Some troubles are experienced in the copper reverb with build-up of ferric compounds from zinc plant residues which are added with the copper charge.

Copper Metallurgy. Two copper reverbs have been in the news. One of them at Miami, Ariz., described by Harold Foard, after 31 years of service had 1,200,000 lb of copper in its bottom. At over 40c a pound for copper it is easy to see why Mr. Foard called it a bonanza.

The other reverb we have in mind, is the specially designed one used by Inco for their flash smelting process. In the first article giving details of the process it is stated that a sulphide concentrate with over 15% sulphur can be smelted autogenously with oxygen more economically than by regular processes. In addition to eliminating fuel costs, a furnace gas running 75% SO_2 is obtained.

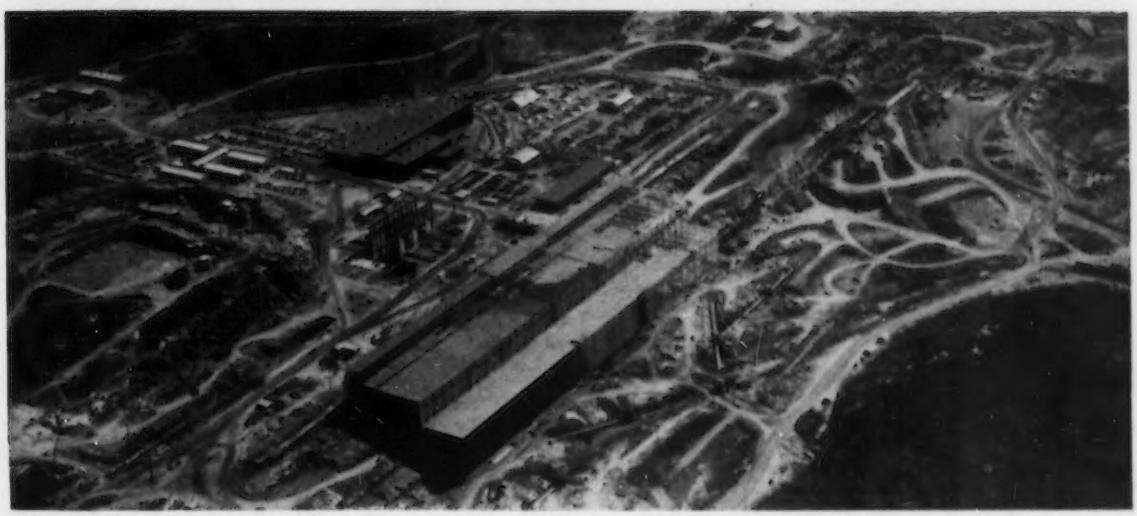
In comparing the Inco oxygen smelting process with the method used at Outokumpu Oy utilizing preheated air, it is said that the choice would depend on the cost of electric power for oxygen manufacture and whether the market was for sulphuric acid or liquid SO_2.

Uranium Metallurgy. With release of papers presented at the Geneva Congress on Peaceful Uses of the Atom, it will be possible for the average metallurgist to find out something about the processes that have been developed for production of nuclear fuels. In addition to problems of concentrating uranium ores and producing uranium metal, it appears that some pyrometallurgical processes might be suitable for reprocessing fuel to eliminate fission products. Evidently this reprocessing is fairly frequent in breeder reactors.

Present methods involve dissolution in acids, followed by solvent extraction, and the subsequent reduction of the compounds thus obtained. Certain metallurgical procedures might be preferrable as the fuel alloy would be kept in a metallic state, and there would be a relatively small volume.

One of the suggestions has been to use a "pyrochemical process such as oxidative slagging." Despite the peculiar terminology we recognize what they mean and it is interesting to note that cerium, strontium and the rare earths can be oxidized preferentially to uranium and plutonium. Other suggested procedures include electro-refining and vacuum distillation•

Iron Ore Beneficiation



ERIE MINING CO.'s taconite plant near Aurora, Minn., is scheduled for completion in January 1957 with an initial rated capacity of 7.5-million tons of pellets per year. This photograph was taken in August 1955. (See *E&MJ* March 1955)

1955 WAS VERY BUSY for the producers of iron ore. In the Lake Superior District lake shipments amounted to 87,459,853 tons which made it the second largest peacetime production on record.

The steel industry, after the first few months of the year, operated at near capacity creating a tremendous demand for iron ores. The demand for ore, although high, has been selective, marking a continuation of the trend that developed in 1954. There has been a heavy demand for ores of standard Mesabi or Old Range quality. However, there has been a distinct reluctance on the part of consumers to take ores with a low natural iron content or those with an above-average silica content. This trend in 1955 has been very marked and is, of course, a result of greatly increased importation of high grade foreign ores that are now coming into the domestic market.

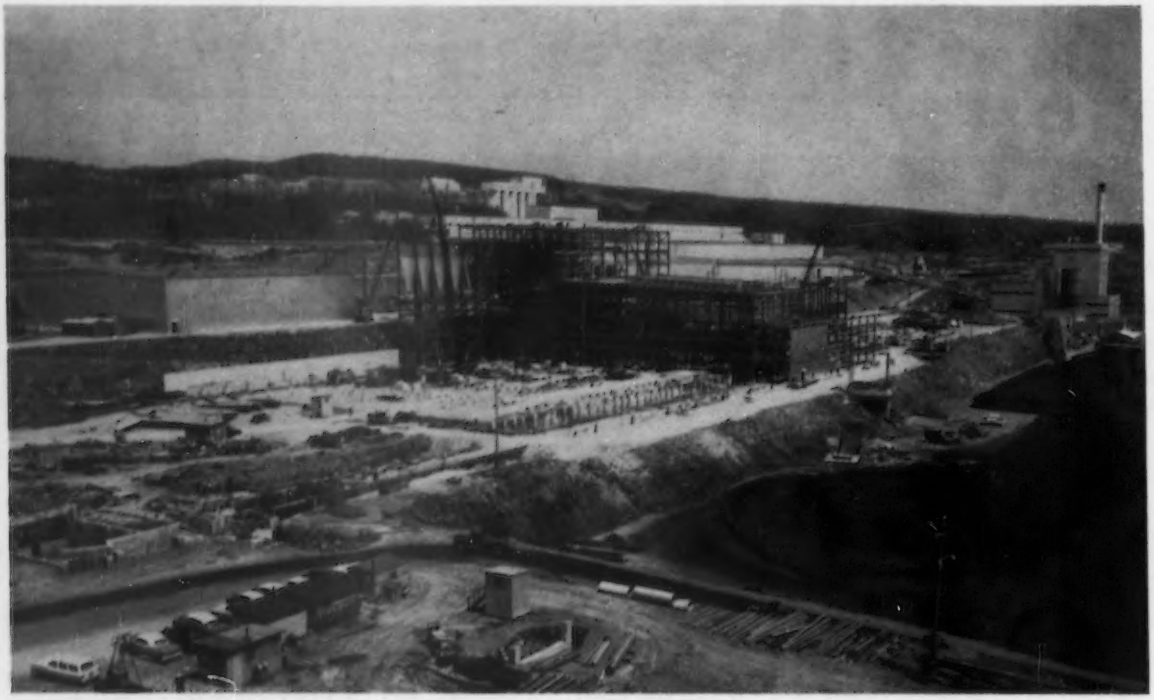
Fred D. DeVaney
Chief Metallurgist
Pickands, Mather & Co.

Exact figures are not as yet available as to the amount of ore imported into the United States during 1955 but it is probable that the figure is in the order of 20,000,000 tons. Much of this increase in imports came from the Labrador area which, during 1955, has a production amounting to 8,522,024 tons. This is a considerable increase over 1954. Additional imports also came into the country from Venezuela. Ores from both areas are relatively high grade and their importation tended to reduce consumption of lower grade domestic ores. It is evident that this trend will continue and probably will be accentuated in the future.

Trade journals have contained many items in recent months on expansion in output by various steel companies. Inspection of these plans usually reveals that most expansion is in facilities for making and finishing steel, and that the expansion of blast furnace facilities is proportionately much less than would be expected. The conclusion is rather obvious that in the future, steel companies expect to produce more pig iron per furnace by use of ores with a higher iron content and better structure. In part, this demand for high quality ores will be supplied by the taconites which are now coming into commercial production and which by the end of 1957 should be producing at the rate of 10- or 12-million tons annually.

There probably will be no diminution in the demand for standard high grade Mesabi and Old Range ores but it is becoming increasingly evident that lower grade materials from the Lake Superior District must be beneficiated both as to grade and as to structure. This will make it necessary to up-grade many ores that have been shipped district in the past. For example. under arrangements with many fee owners it has been the practice to ship direct, ores containing up to 15% silica. It is probable in the future that this cannot continue and that all ores containing more than 12% silica must be beneficiated.

Other ores with a desirable dried analysis but with high moisture content will also probably have to be upgraded both as to natural iron content and as to structure if they are to be readily marketable. All of the facts point up the need and trend for more



RESERVE MINING CO.'s taconite plant at Silver Bay, Minn., began operation in October 1955 and will be completely on stream by March 1956 with an initial production rate approaching 3,750,000 tons of hard, high grade pellets per year.

concentration and more agglomeration plants of one type or another in order to provide the steel industry with a superior product.

Trend towards more concentration was very marked in the Lake Superior district during 1955. Many new mills were built and put into operation and changes were made in many others to improve results. Although figures are not as yet available, they will undoubtedly show that more ore was concentrated during the past year than in any other year previously. The new mills being constructed are in general not the simple screening and washing plants that sufficed for many years to give an acceptable product but are, in most instances, rather intricate plants which contain not only screening and washing equipment but facilities for heavy media separation, cyclones, jigs and spirals for recovering values.

During the year the mining division of the U. S. Steel Corp. put into operation a heavy media, wash and cyclone plant at its Gross-Marble property and also operated for the first season, its new Plummer plant just out of the town of Taconite, Minn. It is also understood that changes are contemplated for its big Trout Lake concentrator near Coleraine, Minn., where heavy media and auxiliary equipment may be added.

Pickands, Mather & Co. put three new concentrators into operation all employing heavy media and cyclone processes in addition to usual washing sections, at its Mahnomen mill on the Cayuna Range at its Tioga No. 2 property on the west side of Lake Pokegama; and at its Bennett mine at Keewatin. A heavy media unit was added by the same company at its Danube mill near Bovey, Minn. P-M also plans erection of a concentrator at the Mahoning mine which has been a shipper exclusively of high grade merch ores for the past 60 years. This mill is scheduled for operation in 1957.

M. A. Hanna Co. is erecting a new mill on its Parcle No. 3 property near Coleraine which will consist of a washing and heavy media unit. The same company during the present season has installed a heavy media plant at the Douglas property. This equipment was moved from the Buckeye mill which has now been abandoned. A scrubber will also be installed at the Douglas mill.

Rhude & Fryberger at its Troy property near Virginia, Minn., started a new plant during the season. This plant consisted of a washing section, with a scrubber and has the rather unusual feature of providing magnetic separators for recovering magnetite from fine tailings.

Pacific Isle Mining Co. took over two mines formerly operated by Republic Steel Corp. on the western part of the Mesabi Range, namely, the Stevenson and St. Paul mines. Company is currently remodeling the St. Paul plant and will install a modern washing plant.

W. S. Moore Co. is moving its mill equipment from the Virginia concentrator to a new location at the Mariska property near Gilbert, Minn. The new Mariska mill will have a new primary crushing and screening section and a new scrubber. The jig section will be double in size.

Cleveland-Cliffs Iron Co. is building a cyclone addition to its present Holman concentrator near Taconite, Minn.

Cyclones found increased acceptance this year both as a means of concentrating the ¼-in. washed portion of lean ores and as a desliming device.

Pickands, Mather & Co. after using 12-in. cyclones for a number of years have replaced them with 10-in. diameter cyclones. This substitution has necessitated using more machines but this company believes that the added sharpness of the separation in the smaller dimension cyclones offsets the number required.

Ni-Hard has become almost the universal lining material. For ore concentration service, rubber linings of any type will not stand the mechanical abuse to which they are subjected.

Several plants on the Mesabi report beneficial results in the use of cyclones for desliming and preparing feed for Humphrey spirals as compared to the use of hydroseparators.

CONCENTRATOR at Erie's Aurora taconite plant is 1,110 ft long, containing 27 mill sections each having a rated capacity of 105 long tons concentrate per hour.

Magnetic Separators. Less experimental work has been done this year than formerly on types of magnetic separators best suited for use in heavy media and cyclone processes. Use of Alnico permanent magnetic separators is growing and they have secured a wide acceptance. In many plants they are used as secondary or scavenger separators but the new Tioga No. 2 plant contains this type exclusively where they have performed well during the 1954 season.

As to strength characteristics, the trend seems to be definitely towards more feet of magnetic width at moderate field intensities, rather than narrower machines with super high intensity fields.

In ore concentration work, the trend has been definitely towards wrap-around stainless steel wear covers in place of rubber. Use of these replacable covers reduces markedly the wear on the drum proper and obviates costly delay due to abrasion of the drum shell with consequent expensive maintenance on the shell or the shorting out of the coils through pulp leakage. Rubber covers for such separators although showing excellent resistance to normal abrasion have been found unable to stand the abuse caused by tramp in the feed.

Magnetite in many Mesabi ores has long been known. In most ores magnetite when present, is in small amounts. At times however, it can seriously disrupt cyclone operation where its presence may upset the cyclone sections. This natural magnetite is usually relatively coarse and tends to give an undesirable size distribution of the magnetite media. At the Hawkins and Bennett mills, this problem was solved by installing magnetic separators to treat feed to the cyclone section. Natural magnetite is removed resulting in the recovery of a small tonnage of high grade magnetite, making cyclone operation smoother.

Research on flotation of iron ores received increasing attention by most major producing companies. Phases investigated include such things as recovery of iron from washing plant tailings, recovery of iron values from ground, gravity-concentration waste products, and from oxidized taconites. Pilot plant operations at the rate of several tons an hour have been carried on by a number of companies over a period of years. It seems likely that within the relatively near future several plants may be built which will treat materials at the rate of 50 tph which should be on a large enough scale to give some answers to this problem.

Cleveland-Cliffs has continued its production and development of high grade iron ore from Michigan taconites. The Humboldt mill, now in its second year of operation, continues to treat specular hematite ores by flotation. A second and larger mill is under construction to treat ores in the Republic area by essentially the same process. This mill is expected to go into production during February 1956. Mill production of both properties will be balled and pelletized by a variation of the grate-type pelletizing process. This process will differ basically from that employed by the Reserve Mining Co. in that the grates will be charged to a considerably greater depth and this depth will be built up by charging the green pellets at intervals along the sintering chain. It will also use an updraft rather than down as is Reserve's practice.

New Producers. New addition to the growing list of iron ore producers around the Great Lakes, is the Marmora plant of Bethlehem Steel Co. at Marmora, Ontario. Magnetite-bearing ore is mined by open pit methods and is concentrated by dry magnetic cobbing. These concentrates are ground to approximately 65 mesh and reconcentrated magnetically for production of a high grade magnetite concentrate. These concentrates are then balled and fired in a shaft type pelletizing furnace. This plant went into production in March 1955 and is rated as a 500,000-ton-a-year producer. Pelletized product is shipped to Picton, Ontario.

Announcement was made late in 1955 that Pickands, Mather & Co. will manage a new property near the town of Bristol in Quebec. In many respects, this property will closely resemble the Marmora operation. Ore is a magnetite and the same methods of open pit mining, dry magnetic cobbing, fine grinding, magnetic concentration and shaft-type pelletizing will be followed. The property is expected to produce 600,000 long tons of high grade pellets per year and is scheduled to go into production in September 1957.

As far as iron ore beneficiation is concerned, concentration of the Mesabi taconites held the center of the stage. Three large pilot plants operated by Oliver Iron Mining Co. at Mountain Iron, Minn., Erie Mining Co. at Aurora, Minn. and Reserve Mining Co. at Babbitt, Minn., were in continuous operation throughout the year. Of the two large commercial production units, Reserve Mining was placed in partial operation during October 1955, and that of Erie was well underway•

PERSONALS

American Zinc Institute Changes

AMERICAN ZINC INSTITUTE, INC. has announced the retirement of **Ernest V. Gent,** (left) who has served the Institute for 20 years as secretary and executive vice president. **John L. Kimberley** (right), secretary of the Institute, has been named to succeed Mr. Gent, who will continue to serve the Institute as a special consultant. Mr. Kimberley was formerly with American Smelting and Refining Co.

C. H. Richards has accepted a position as manager of National Lead Co.'s new mine in Argentina. His headquarters will be in San Juan.

Richard J. Councill, geologist with the mineral resources division of North Carolina State Department of Conservation and Development, has resigned to become chief geologist for the Atlantic Coast Line Railroad. He succeeds **J. R. LeGrand,** who resigned to join International Minerals and Chemical Corp. in Chicago.

G. R. Kennedy, former vice president and general manager of Navajo Uranium Co., and manager of uranium exploration for Kerr-McGee Oil Industries, Inc., has returned to private consulting work, specializing in uranium property evaluations.

Angus D. Campbell, staff engineer and manager of the Castle-Trethewey silver mine, McIntyre Porcupine Mines, Ltd., has retired. Mr. Campbell joined McIntyre in 1927. He is succeeded by **George D. McLeod,** named mine manager.

Don A. Rohrenback, 1955 graduate of Montana School of Mines, won an award in the 14th annual student prize-paper contest sponsored by AIME.

Climax Molybdenum Co. has promoted three production officials. **Edwin J. Eisenach,** assistant general superintendent since 1954, has been named general superintendent of the Climax mining and milling operation. **John M. Petty,** mine superintendent, has been named assistant general superintendent, and **William F. Distler,** assistant mine superintendent, has been named superintendent of the mine department.

Dr. E. T. Casler has been named manager of the Florida operations of the phosphate minerals division of International Minerals & Chemical Corp., succeeding **Floyd B. Bowen,** who was made production manager of the division's operations in Florida, Tennessee and Montana.

Russell M. Allen, vice president in charge of sales, has retired but continues as vice president and director of Allegheny Ludlum Steel Corp. He is succeeded by **William B. Pierce,** who was formerly vice president and technical director of the corporation. **Dr. Rush A. Lincoln** has been named technical director succeeding Mr. Pierce. Dr. Lincoln was chief metallurgist.

Charles D. Michaelson, until recently vice president of Braden Copper Co. in Chile, has been promoted to a higher post with Kennecott Copper Corp. in the U. S.

Lawrence F. Boland, vice president sales; **William D. Gamon,** vice president; and **Walter R. Lowry,** treasurer and assistant secretary of the Beryllium Corp., have been made directors of the company.

Don J. McEachern, engineer with Imperial Oil's production department, has been elected chairman of the northern Alberta branch of Canadian Institute of Mining and Metallurgy, succeeding **Prof. T. H. Patching,** University of Alberta.

Charles Wm. Smith, geologist with American Smelting and Refining Co.'s exploration division for eastern U. S., has been transferred to Peru as resident geologist at the Quiruvilca unit of Northern Peru Mining & Smelting Co.

S. Power Warren, consulting engineer, has been named by President Eisenhower as assayer at the United States Mint in Denver.

Arthur S. Klopf has been named manager of marketing for American Gilsonite Co. at Salt Lake City, Utah. He was formerly general sales manager of the Missouri Coke and Chemical division of Great Lakes Carbon Corp., and is a licensed professional engineer.

Wilbert A. Walker, vice president-accounting has been elected comptroller of U. S. Steel Corp., succeeding **Robert C. Tyson** who continues as vice chairman of the finance committee and vice president. **C. Burton Vernooy** has been named assistant vice president and **James L. Ortner,** assistant comptroller.

Allen E. Jones has been named to succeed **Sheldon P. Wimpfen** as manager of the AEC's Grand Junction Operation Office. He has been deputy manager. Mr. Wimpfen resigned to become vice president of Glen Alden Corp., Wilkes-Barre.

Magma Copper Co., Superior, Ariz., has announced the following appointments: **J. F. Buchanan,** assistant general manager operations, Magma Copper Co. and San Manuel Copper Corp.; **F. H. Buchella,** general manager, San Manuel operations, San Manuel Copper Corp.; **C. B. Foraker,** general manager, Superior operations, Magma Copper Co.; **J. L. Draeger,** mine superintendent, superior operation, Magma; **E. K. Staley,** assistant mine superintendent, San Manuel operation, San Manuel; **W. P. Goss,** president and general manager, Magma Copper Co. and San Manuel Copper Corp.; **H. J. Rex,** mill superintendent, Magma; **E. J. Caldwell,** smelter superintendent, Magma; **C. L. Soule,** assistant smelter superintendent, Magma; **C. L. Pillar,** mine superintendent, San Manuel; **E. V. Given,** mill superintendent, San Manuel; and **R. C. Wilson,** smelter superintendent, San Manuel.

William Wiltschko, metallurgical supervisor for Aluminum Co. of America, Vancouver, Wash., has been named chairman of the Oregon section, AIME.

J. L. Whiteside, plant manager at Monsanto, Idaho, since 1953, has been named plant manager of Monsanto Chemical Co.'s elemental phosphorus plant at Monsanto, Tenn. **Robert R. Rumer,** production superintendent at the Tennessee plant, succeeds Mr. Whiteside in Idaho. **Ralph Neubert,** maintenance superintendent, has been named production superintendent at Tennessee, and **William G. Allen,** maintenance supervisor, has been named maintenance superintendent.

Is the first U. S. Rubber Ustex-nylon conveyor belt still on the job?

Overall view of mine, showing conveyor belt system.

"U. S." uncovered an interesting answer

The very first Ustex®-nylon belt was installed by "U. S." in May, 1948, in a Minnesota iron mine. Originally, it was installed in two sections, to carry 700 tons per hour. After years on this job, carrying over 7,500,000 long tons, the belt was moved to another location to replace a belt of different make that had failed. On its new job the Ustex-nylon belt was spliced in one piece and installed on the job site by "U. S." service engineers. It now handles *not* 700 tons, but 1200 tons an hour on twice the center distance and a higher lift. Yet year after year the belt continues to do *twice the work it did originally!* The pleased mine officials placed an order for 1829 additional feet of "U. S." belting for further expansion.

This Ustex-nylon belt has Ustex for strength, nylon for flexibility, and is an example of the many pioneering developments of "U. S." in materials haulage. Cut costs to the bone by making use of U. S. Rubber's *Three-Way Engineering*, in which "U. S." engineers work closely with the mine engineers and the conveyor system engineers. Get in touch with one of the 27 "U. S." District Sales Offices, each staffed with sales engineers, or write to us at Rockefeller Center, New York 20, New York.

The Ustex-nylon belt carrying iron ore. The lumps are up to 6" in size, weighing up to 150 lbs., and the belt must and *does* withstand a severe battering.

Mechanical Goods Division

United States Rubber

PERSONALS *(Continued)*

J. LOUIS REYNOLDS, vice president of Reynolds Metals Co., has been elected executive vice president of the company, succeeding Marion M. Caskie, who retired December 31. Mr. Reynolds became associated with the company in 1933 in the insulation division.

DAVID A. STRETCH has been named executive vice president of the Atlas Corp. A senior partner of the law firm of Simpson Thacher & Bartlett, counsel to Atlas, he has devoted much of his time to Atlas affairs, serving as an officer of the company.

Sherman A. White and **Floyd E. Albertson** have been named assistant general managers of Nickel Processing Corp., operators of the Government-owned nickel processing plant located at Nicaro, Cuba.

Bert A. Robbins, division comptroller, has been named assistant to the general manager, Chino Mines division of Kennecott Copper Corp. **Howard R. Miller,** assistant division comptroller, succeeds Mr. Robbins.

Felix E. Wormser, Assistant Secretary of the Interior, has been named 1956 recipient of the Egleston Medal, Columbia University's highest award for "distinguished engineering achievement."

Dennis W. Viles, vice president of Vanadium Corp. of America, has been named to the Colorado state metal mining board to fill the term of the late Charles A. Chase.

The Council of the Institute of Metals has announced the following awards of medals: Institute of Metals Medal in Platinum for 1956 to **Professor Georges Leon Chaudron;** Rosenhain Medal for 1956 to **Dr. Donald McLean;** W. H. A. Robertson Medal for 1955 to **E. J. Thackwell.**

James F. Roe, assistant manager for production, has been named manager of Florida operations of the Phosphate Chemicals division of International Minerals & Chemical Corp. and **Charles A. White,** plant superintendent at Wales, has been named manager of the division's Tennessee operations. **Robert V. Safford** has been named assistant manager of the Florida operations, and **Ralph W. Lorentz** has been named plant superintendent of the division's Bonnie plant, near Bartow, Florida.

Orville Wright has been named comptroller of the Southern Peru Copper Corp. Joining American Smelting & Refining Co. in 1922, he was named assistant general auditor in 1949, the position he held until this appointment. **Robert B. Muse** was named chief engineer of Southern Peru. Before this appointment, he had been chief construction engineer at Salt Lake.

OBITUARIES

S. Paul Sullivan, 56, assistant to the manager for contract coordination at the AEC Grand Junction Operations Office, died Dec. 3. He had been with AEC at Grand Junction since 1948.

Ernest Russell Dickie, 53, who directed the development of Bagdad, Ariz., Copper Corp. from a small underground mine to a major open pit operation, died Dec. 14 following a heart attack. He had been with United Verde Copper Co. and United Verde Extension Copper Co., and from 1935 to 1944, was president of East Vulture Mining Co. located at Wickenburg.

William J. Murphy, 60, vice president in charge of sales and a director of American Potash & Chemical Corp., died Dec. 11 following a heart attack, at Glen Ridge, N. J. Mr. Murphy began his career in 1911 with a predecessor company to American Potash.

Burt B. Brewster, 65, editor and publisher of *The Mining and Contracting Review,* of Salt Lake City, died Oct. 29 of a cerebral hemorrhage. A mining engineering graduate of Michigan College of Mines, he served as chief engineer of Willis Coal & Mining Co. and Columbia Quarries Corp.

Dickson Hammond Leavens, a contributor of a number of articles published in these pages, died Dec. 3 following a heart attack. He was well known in the silver industry.

Carl J. Trauerman, 70, secretary-manager of the Mining Association of Montana, and news correspondent for *Engineering & Mining Journal,* died Dec. 17 at his home, following a heart attack.

H. C. Miller, 66, regional director at San Francisco, of the U. S. Bureau of Mines, died Dec. 18 in Las Vegas, Nev., following a heart attack. Mr. Miller joined the USBM in 1923 and was director for the western states since 1949.

Herbert Richardson, 69, retired chief chemist for Pickands, Mather & Co., died Dec. 8.

Charles E. Schnure, 80, died Dec. 30 at Phoenix, Ariz. A mine contractor, he had installed shafts for Arizona Magma Copper Co. and Kay Copper Co. and installed heavy equipment for the Ray Hercules mine.

JOSEPH H. HEDGES, 73, serving the U. S. Bureau of Mines for nearly 30 years until his retirement last July, died January 12 after a brief illness, at a Washington, D. C., hospital. In 1943-45, he supervised work on the Bureau's San Manuel copper project, Pinal County, Ariz., biggest wartime discovery of copper reserves. In 1949 he was recalled to Washington as chief of the mineral division, and in 1952 became a special assistant to the director. He was awarded the Interior Department's Distinguished Service Award in 1953.

JENKINS Fig. 106-A

The FIRST
Renewable Composition Disc
BRONZE GLOBE VALVE
150 lbs. Steam 300 lbs. O.W.G.
⅛ in. to 3 in.

Making a Work Horse a Champion

Take a Fig. 106-A apart. It's easy to see the reason why it's the "champion" of disc-equipped Bronze Globes. Every part, from heatproof handwheel to pipe ends, reflects the design and construction skill of generations of Jenkins Valve specialists.

Jenkins Bros. introduced the first renewable composition disc Globe . . . is still the only manufacturer of both valves *and* discs.

Fig. 106-A not only looks better — it proves out better in performance. In any comparison, its long-life, low-upkeep record has always set the standard. That is the true measure of valve cost — and it is the reason why industry's shrewdest buyers will settle for nothing less than Fig. 106-A quality.

The Fig. 106-A "family", with interchangeable parts, provides Globe, Angle, and Check patterns to meet 90% of average valve needs.

Ask your Jenkins Distributor for full information, or write: Jenkins Bros., 100 Park Ave., New York 17.

SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

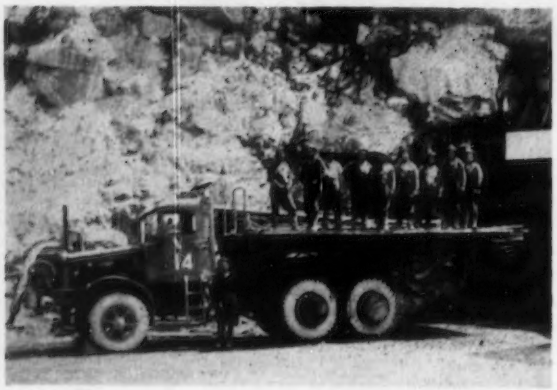
JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
SINCE 1864 TRADE JENKINS MARK
Jenkins Bros

OPERATING IDEAS

LLOYD E. ANTONIDES, Assistant Editor

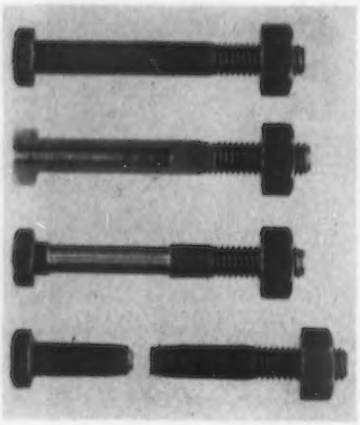
Cartoon Is Clever Safety Aid

HERE'S SOMETHING that might prove helpful in your safety program—a "how-many-can-you-find" type of cartoon of bad practice. Try it in each issue of your company paper as does the Koehring Co., Milwaukee, Wis., in their monthly "Koehring News." Or try a large one on a bulletin board. Get a local artist to draw it and perhaps offer a free cigar to those that find all the bad practices to lend more interest. National Safety Council issued this one.



Truck Makes Handy Drill Jumbo

CONVERTED haulage truck is used as a drilling platform in driving two vehicular tunnels in walls of International Nickel's Frood-Stobie open pit in Sudbury District, Ontario. When vehicle is backed into position at face, three drillers stand on rack with their machines, and four others stand on floor. Tunnels eliminate part of old pit road and permit mining ore otherwise possible only from underground. Traffic will be controlled with stop and go signals at portals.



Method Adds Impact Strength

WAY TO INCREASE strength of bolted joints subject to shock loads was described at recent ASME meeting. Method removes precise amount of material from shank of bolt thus reducing shank to optimum size depending on type of bolt, method of manufacture and heat treatment.

Top bolt in photo is ordinary machine bolt. Second is cut-away showing optimum amount of metal drilled from center. Third bolt has same strength added by removing same amount from outside. Bottom photo shows effect of taking too much from center.

Although bolts modified in this way, weigh less than in original form, capacity to absorb impact energy is several times greater than ordinary bolts. Report said this property may prove valuable in rock crushers and other machinery where parts are subject to sudden and repeated shock loads.

In addition to greater impact strength, modified bolt permits greater stretching during tightening. Consequently, nuts are less likely to loosen because of vibration. Also, resistance to fatigue failure is increased so bolt will last longer in rough service.

Oran A. Pringle, assistant professor of mechanical engineering at University of Missouri, and John Love Jr., now with GE, made study.

Radio Is Hazard To Electric Blasting

WIRES in an electric blasting cap can act as an antenna to pick up radio energy and if configuration is just right within vicinity of a radio transmitter, they will heat enough to explode cap. Both mobile radios and commercial broadcast stations radiate sufficient power.

These statements were made in a public bulletin issued in southern California by M. J. Shelton, general manager of La Mesa, Lemon Grove and Spring Valley Irrigation District, in conjunction with Pacific Telephone & Telegraph Co. and Federal Communications office, San Diego. In same bulletin, S. B. Morris, general manager of Los Angeles Department of Water and Power recommends that:

1. Electric blasting caps should not be transported in cars with two-way radios.

2. They should only be transported in their original container and none should have their wires extended.

3. All cars with two-way radios while within 300 ft of any electric blasting operation should have the transmitter turned off.

4. Only a non-electric blasting method such as blasting cap and fuse, or primacord with blasting cap and fuse should be permitted if within two miles of a commercial broadcasting station.

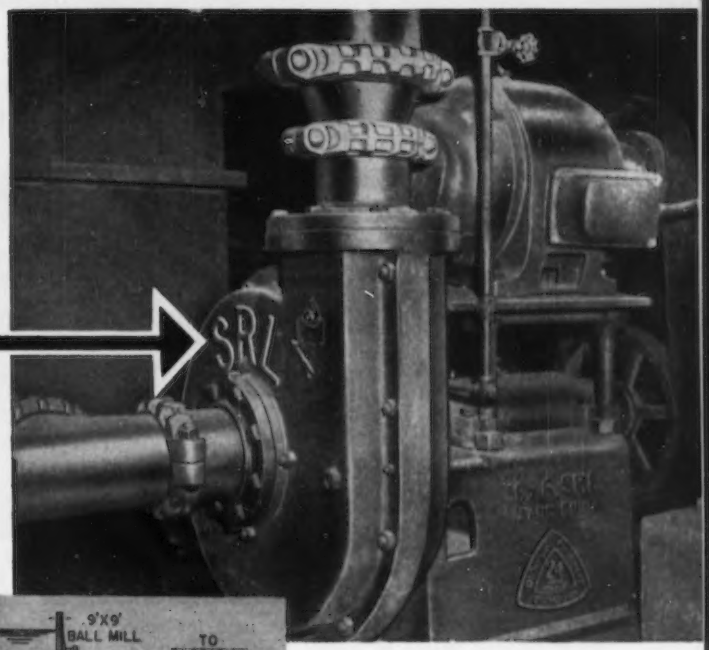
Two engineers of the Irrigation District, D. G. Raasch and Bert Williams, proved the danger in experiments following some accidental explosions. Other groups mentioned also studied problem. Their work has resulted in the bulletin and a proposed revision in state law.

Proposed revision to Construction Safety Code states that electric blasting caps and electric blasting operations should be kept:

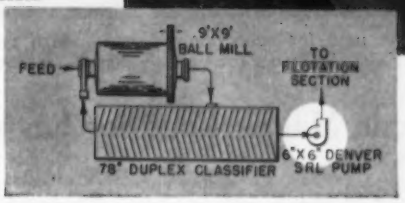
100 ft	from	0 to 29	watt transmitter
200 "	"	30 to 99	" "
500 "	"	100 to 249	" "
1,000 "	"	250 to 999	" "
2,000 "	"	1 to 4.9	kw "
5,000 "	"	5 to 50	" "
10,000 "	"	over 50	" "

Radar and international broadcasting equipment require even greater distances.

DENVER SRL PUMPS AT Climax



Here's why Climax Molybdenum Company has 44 Denver SRL Sand Pumps in it's modern, efficient mill



A 6"x6" Denver SRL Sand Pump operating at 690 r.p.m., handling 2200 tons per 24 hours of —28 mesh classifier overflow material at 45% solids. Life of pump runner and casing liner was 593,000 tons.

BACKGROUND

Originally, a 2"x2" Denver SRL (Rubber Lined) Sand Pump was installed on a trial basis at Climax to handle coarse, abrasive —28 mesh deslimed pyrite flotation concentrates. Later, Climax purchased one 6"x6" Denver SRL Pump to handle the problem described with the photo above.

RESULT

Operation of these original Denver SRL pumps was so successful that, as a direct result, 42 additional Denver SRL Sand Pumps have been installed in this outstanding mill. These new pumps vary in size from the 2"x2" SRL (Open Runner) to the 8"x6" SRL-C (Closed Runner).

REASON

The Climax operators have found the efficient, trouble-free operation of Denver SRL Pumps entirely satisfactory. Life of wearing parts is long and shut-down time minimized. Horsepower requirements have been low and high efficiencies have resulted. Obviously, the Denver SRL is a big success at Climax.

HOW DENVER SRL PUMPS CAN REDUCE YOUR PUMPING COSTS

Send full data to us today regarding your particular pumping problem. Experienced DECO engineers will evaluate your problem and will return correct and workable recommendations immediately. This will obligate you in no way.

We carry replacement parts for all sizes of Denver SRL Sand Pumps in our Denver stocks. This enables us to give you prompt service whenever you may need it.

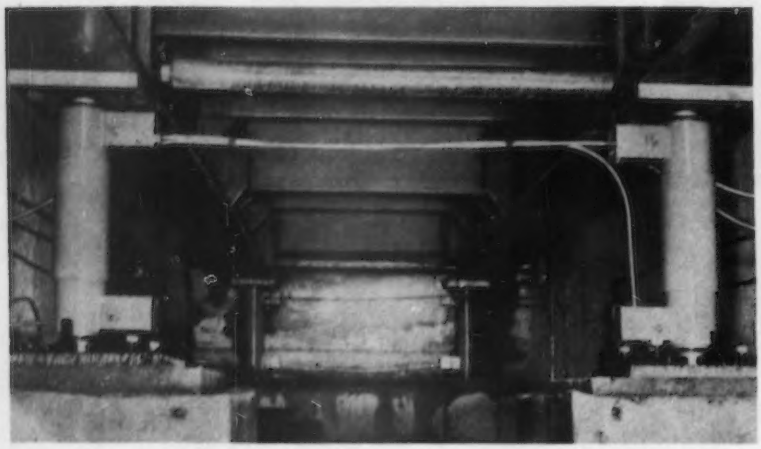
WRITE FOR FREE BULLETIN

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

"The firm that makes its friends happier, healthier and wealthier"

DENVER, NEW YORK, CHICAGO, EL PASO, SALT LAKE CITY, VANCOUVER, TORONTO, MEXICO, D.F., LONDON, JOHANNESBURG

DENVER EQUIPMENT CO., 1400 Seventeenth St., Denver 17, Colorado



FAST ACTING load cells eliminate need for bulky lever arms in weigh scale. Wires transmit weight to control booth. Each end of car is weighed separately.

PITS for scale are under hopper bins. Four chutes spread load evenly in cars.

Electronic Scale Makes Loading Faster and More Exact

AN ELECTRONIC LOADING CONTROL is saving a huge capital outlay for railroad cars in Labrador operations of Iron Ore Co. of Canada. By making loading faster and more precise, the device is expected to permit loading at least 3 tons per car more than otherwise possible. For 1956 target of 10-million tons this represents 120 cars.

Not only is time critical in moving ore during the April-to-October mining season at Knob Lake, but underloading wastes capacity and overloading means high maintenance on cars and track. The problem is further complicated because accurate visual loading is impossible—specific gravity of ore varies too much. It is solved by the electronic load controller.

Loading and weighing each of the four daily 130-car trains requires less than 30 minutes. Each car weighs 55,000 lb empty, 250,000 loaded. Thus each train carries over 12,000 tons.

At the loading point, a belt conveyor carries ore from crusher to hopper bins. Beneath the bins, a railroad track runs over pits housing two 12½-ft long weigh-bridges placed in tandem, one for each axle of car. Four loading chutes with hydraulically actuated gates feed each car. Operator is stationed nearby in a glass fronted booth which also houses load indicator. As car is loaded, pointer of indicator moves horizontally across colored chart. Initial loading section of chart is white, then orange as correct load is approached. Between limits of correct load, chart is green. Overload portion is red. Weight indication calibration is large scale in green and red zone, less so in orange and condensed in the white. Indicator is preset to desired load by operator. Operator or automatic control on indicator, closes each chute gate at correct load for even distribution.

Scale itself is similar to that used at southern end of railway at Sept Isles, Que., and several other freight yards in this country. Key part is load cell. Eight are used in the Knob Lake scale. They are strain gages, made of resistance wire mounted on short steel columns, in which electrical resistance is proportional to compression due to weight.

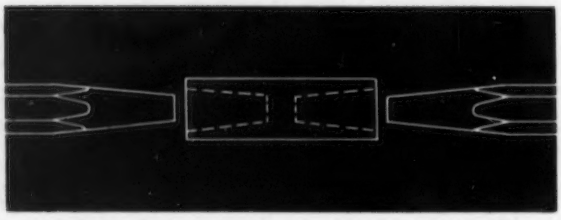
Cells are placed on top of vertical tubular steel struts—8 in. diameter, 24 in. long—to eliminate side load inaccuracy. Cells directly support weigh-bridge beams which carry track.

Maker of unit is Cox and Stevens Aircraft Corp., division of Revere Corp. of America, Wallingford, Conn. The company first applied cell to weighing aircraft in 1943 when they developed a portable outfit for Air Force. Since then they have been working on similar leverless heavy duty scales for industry.

Two additional load controllers are ordered for the Labrador fields. They will be installed at other loading points.

Coupling Adds Life To Steel

BROKEN STEEL and gage-worn but still useable starters were saved from the scrap pile by use of XL-type tapered couplings at mines of St. Lawrence Corp. of Newfoundland Ltd., St. Lawrence, Newfoundland. Donald A. Poynter, vice president, says that use of Swedish alloy steel with integral tungsten carbide inserts gave them two problems—broken steel and gage-worn starters. This coupling whipped the problems. Broken steel is simply squared off and ground to the necessary taper on each end, then inserted into the coupling. As he says, "The coupled steel has greatly outlasted pressure-welded joints and is considerably cheaper. And since our abrasive ground causes large gage wear on our inserts, a large stock of starters with lost gage but still usable tungsten carbide accumulated until we hit on the idea of cutting off the bit, grinding a taper and proper gage and mounting the bit with the coupling on a longer rod. Our records indicate that we were able to get an additional four hundred to five hundred feet of drilling from each of these reclaimed starters."



BROKEN steel is readily joined after grinding taper on ends.

Here's the answer to any **BIG** crushing job

The NEW KENNEDY No. 48 GEARLESS GYRATORY CRUSHER

Designed by KVS to handle large sizes of quarry rock regardless of hardness. Crushes any type ore or rock that will freely pass the 48" feed opening.

FEATURES WHICH DISTINGUISH THE NEW KVS No. 48 GYRATORY CRUSHER

- Primary Crusher
- Gearless... Gyratory Model
- 450 HP, 110 RPM Synchronous Motor built into pulley assembly
- Low-head Construction
- Power used only for crushing
- Minimum maintenance and operating cost
- Produces peak capacities
- All moving parts carried on roller bearings

Send for bulletin describing KVS Crushing Machinery and Equipment . . . see why it costs less to own the best.

KENNEDY-VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

TWO PARK AVENUE, NEW YORK, N. Y. • FACTORY: DANVILLE, PA.

Mining States Legislators Appear at Silver Hearings

WESTERN SENATORS appeared in opposition to repeal of Senate bill 1427 at hearings of the Senate Banking and Currency Subcommittee, chairmanned by Sen. Paul H. Douglas, Democrat of Illinois. S.1427 would repeal the law under which the Government accepts newly-mined domestic silver at a seigniorage charge of 30% of the $1.29 coinage price.

Sen. Carl Hayden (D.-Ariz.), opposing the measure, said it would provide no benefit to the silver-consuming industry with the world price of silver (91c) above the price which domestic producers receive from the Treasury Department (90.5c). Sen. Hayden noted that a stable silver market has beneficial effects upon production of many basemetal ores, and, in effect, acts in the interest of national security while also having a stabilizing effect upon employment in the mining industry of the U.S.

The Arizona Democrat also pointed out that the present silver legislation has resulted in considerable seigniorage profit for the Government and asked the Subcommittee to consider the monetary role of silver in backing U. S. currency before it considered taking any drastic action on S.1427; the bill was introduced in the Senate by Sen. Theodore F. Green (D.-R.I.).

In the course of his testimony, Sen. Hayden introduced a letter from Charles F. Willis, secretary of the Arizona Small Mine Operators Association, expressing his group's opposition to the bill. The Willis letter was accepted as part of the record of the Subcommittee's proceedings.

Silver Production Census

Sen. Wallace F. Bennett (R.-Utah), a member of the Subcommittee, said that a number of statements were to be submitted to the investigation by silver producers, which would complete testimony by opponents of the new bill. Chairman Douglas said a questionnaire may be sent to producers in the "near future" to obtain silver production statistics. American Mining Congress urged its members to register their views on the Green bill and itself submitted a statement to the Subcommittee, urging "that the existing Federal policy of acquiring newly-mined domestic silver for monetary needs be continued and that stocks of silver so acquired be held inviolate for such purposes; also recommending that Congressional action recognize the increased cost of producing silver by reducing the seigniorage now charged by" the Department of the Treasury.

Sen. Henry C. Dworshak (R.-Ida.) said, in his statement of opposition to the bill, "there is widespread misunderstanding throughout the United States as well as in Congress on the present program." Dworshak emphasized the monetary role of silver, as mentioned by Sen. Hayden, and called Subcommittee attention to the beneficial role of the silver program in 1953 and 1954, when lead and zinc prices were depressed and many mines were able to carry on with their operations only because silver values in their ores made such operation economic. The Idaho Republican said the U. S. was spending billions of dollars on military preparedness, and challenged any individual to show that such domestic production of minerals is not in the interest of "national welfare and security." He added that production of other strategic and critical minerals such as cobalt had been encouraged by a stable silver price.

Sen. Gordon Allott (R.-Colo.), appearing before the Subcommittee, also stressed the importance to the nation of a healthy domestic mining industry and told the group of legislators that if S.1427 were enacted, many domestic mines would be forced to close down. He noted that his state has more than its share of ghost towns today, and cautioned the Subcommittee that passage of the bill would create many more such monuments to defeated hopes throughout the West.

Gradual Slowing in Stockpile Operations Seen in President's 1957 Fiscal Message

THE BRAKES ARE ON the Government's Strategic Stockpile program, according to Washington observers, in their interpretation of President Eisenhower's annual budget message to Congress for the fiscal year 1957.

In his message, the President noted that an "increasing number" of stockpile goals are being met; those that haven't been met are nearly all two-thirds to three-quarters filled. Industrial expansion, says the President, has resulted in Government having to defer a number of its quarterly quotas to industry use.

As a result, the 1957 fiscal budget grants no new funds for stockpile and defense production expansion. Expenditures for the proposed budget are estimated at $378-million, compared with estimates of $475-million for the current fiscal year—which figure is, itself, well below the $783-million carried in the budget.

GSA purchases for 1957 are budgeted at $335-million, with another $347-million ticketed for Presidential funds, including "expansion borrowing" authority. But subtracted from that total is $304-million which Government expects to get back from its own public enterprises, including the Nicaro nickel operation in Cuba and the Longhorn tin smelter operations at Texas City, Tex.

In addition to the budget cuts, the National Security Council is considering dropping the stockpile goals from a 5-year to a 3-year basis. Reduction partly reflects a compromise with the "short-war" view, which holds that in event of nuclear attack, long-range stockpiles will not be needed.

Defense officials are reluctant to talk about just what the 2-year cutback in stockpile goals would mean. One thing is seen sure by observers—less Government buying, more diversion of stockpile-bound materials to industry uses.

Office of Defense Mobilization, with director Arthur D. Flemming on the Security Council, is reluctant to change the goals. Pressure on the Council is being applied from other sources, however, reportedly from Commerce Secretary Sinclair Weeks and possibly from Defense Secretary Charles Wilson.

Administration Plans More Barter in Metals

DEPARTMENT OF AGRICULTURE has reported that barter contracts—under which surplus farm products are traded with other friendly nations for strategic and other storable minerals and materials—with an export value of some $43.7-million were negotiated by the Commodity Credit Corp. in the quarter ending last Sept. 30. Export value of such contracts for the fiscal year ending June 30, 1955 was $281.8-million. Administration is reportedly contemplating expansion of the barter program.

Strategic and other materials delivered to CCC by barter contractors during the quarter had a value of $26-million, compared with deliveries worth $82.6-million in fiscal 1955. Deliveries of surplus farm products to barter contractors have a dollar value more than double that of materials received, but the contractors have until Sept. 30, 1958 to make deliveries in return. According to the Department, "contractors have provided adequate financial coverage in the form of irrevocable letters of credit or cash deposits" to cover the difference.

CCC will continue to barter agricultural commodities for both strategic and non-strategic materials, some of which are turned over to ODM and some stored

ALLIS-CHALMERS
Rubber-Lined
PUMP

Up To 50 Times Longer Life

than best alloy pumps for handling fine mesh materials

PERFORMANCE records from twenty years of handling all types of slimes, slurries and other fine mesh abrasive suspensions show definite savings from the use of Allis-Chalmers Rubber-Lined Pumps. Instances of 10 to 50 times the life of the finest alloy pumps built for this service are common. Not only are pumping costs reduced, but production lost from shutdowns is almost eliminated and standbys often can be done away with.

Unique Lining Method

One secret of this amazing record is the rubber lining of the Allis-Chalmers pump. It is bonded to a heavy steel skeleton which is simply fitted into the casing. The lining and the casing are not bonded together. When the lining finally must be renewed, the pump need not be removed from its location. Replacement cost is kept to a minimum.

Each Installation Specially Engineered

Every pump is individually engineered to provide the best possible performance for the application involved. Special rubber linings of various compounds are available to handle a variety of slurries at low per-gallon pumping cost. Allis-Chalmers can furnish a complete coordinated pumping unit — pump, motor, control and drive — ready to install and run.

If you are handling sand, taconite, grinding mill discharge, tailings or any other abrasive slime or slurry, ask your Allis-Chalmers representative to show you how you can get long pump life and low cost per gallon pumped. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, and ask for Bulletin 52B8156. A-4768

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

by CCC. Among minerals and materials for which the agency will currently consider barter proposals, according to The American Mining Congress Bulletin, are: aluminum, antimony, asbestos, bauxite, cobalt metal, copper, graphite, beryl ore, bismuth, cadmium, chromate, manganese ore, mica (Muscovite block and film), nickel, platinum, selenium and talc (steatite block).

Defense Officials Give Land Withdrawal Data

PUBLIC HEARINGS on military withdrawals of public lands were held in early January before the House Committee on Interior and Insular Affairs, Rep. Claire Engle (D.-Calif.) presiding. General purpose of the hearings is to determine Defense Department policy on withdrawals by the military and, according to the American Mining Congress, study such related matters as "use capacities, degree of utilization and the extent to which joint agency use agreements are in effect."

Witness from the Departments of Defense, Army, Air Force and Navy presented statistics on land holdings by each service and explained procedures followed in land acquisition. A rather red-faced Navy Department witness explained that a discrepancy in earlier reported inventories was the result of faulty operation of some of the defense agencies tabulating machines. This faulty operation resulted in announcing of acreage holdings in 1953 that were "either twice or half of the holdings" actually under military control.

Total land holdings, according the current testimony, were reported to be 24,173,000 acres, of which 11,784,000 were from public domain lands and 2,244,000 acres were held under temporary use permits. A large portion of the latter is also public domain land.

Witness also revealed that pending applications for additional public lands for all the military services total between 7- and 10-million acres.

The Department of Defense testified that it has been reviewing applications submitted by the Army, Navy and Air Force for permanent land withdrawals since 1953 but that it does not review applications for temporary withdrawals. Contrary to this testimony, the Department of the Army testified that it submits its applications for land withdrawals to the Department of Defense for review only when the value of a withdrawal exceeds $25,000, regardless of whether it is a permanent or temporary withdrawal. In reply to questions from the Committee, the Army revealed that the value of a public land withdrawal is determined by an appraisal which is usually a "good guess."

House Interior Committee will hold further hearings on the subject and plans a case-by-case study.

Labor This Month

BIG LABOR'S TOP TARGET—COMMUNISTS AND RACKETEERS: The number one internal problem of the newly-merged AFL-CIO will be an attempt to oust undesirable union officials in the federation. AFL-CIO leaders mean business. They will move against those affiliated unions whose policies are controlled by Communists or corrupt officers through a new top-level Ethical Practices Committee. Part of the plan is to keep a check-rein on all the unions to see that unwanted unions and union leaders don't penetrate the AFL-CIO from the outside.

This means the giant Teamsters Union—largest of AFL-CIO affiliates—will be closely watched to see how it handles its mutual aid pact with the Mine Mill and Smelter Workers union. As long as the pact remains informal and does not cross federation programs, there will be no pressure to break it up. But if the Teamsters move to absorb Mine-Mill—which could happen—it could mean Teamsters expulsion.

HOUSECLEANING—A BOOM OR BUST PROPOSITION: Attempts by the Ethical Practices Committee to clean up union labor may run into a stone wall. AFL-CIO merger was founded on the proposition that all its unions are autonomous and the federation has no right to invade their private territories. But AFL-CIO leaders are so concerned about reaction of rank-and-file members, and the public, to reports of Communism and corruption that they'll attempt to by-pass some rights.

Major resistance on the part of suspect unions could stall the move before it gets off the ground. But if the federation leaders give up on the campaign, it could lead to a break-up of the federation. In any case, clean-up efforts bear watching.

MINE-MILL RETRENCHES: MMSW officials are pulling in their public relations lines in the face of opposition by the Federal Government and labor's AFL-CIO. In the past years, challenges to Mine-Mill have brought quick counter-blows from a fast-stepping team of public relations experts. Now, however, there's no attempt to counter unfavorable publicity. Two former press experts—Rod Holmgren and Morris Wright—are gone from the union hierarchy and other officers are unavailable for comment.

MINE MANAGEMENT FACES NEW UNION TROUBLES: Employers in the non-ferrous industry will be caught in a union cross-fire in the months ahead. In some cases, the Mine-Mill-Teamster alliance will be pitted against the giant Steelworkers union; in others, AFL unions may find Mine-Mill on their side when the Steelworkers attempt to move in. A preview of coming troubles is evident in two events so far:

- A representation election at Anaconda's new Columbia Falls plant was won by the AFL over the Steelworkers union. Victory was the result of Mine-Mill's decision to step out of the race and side with the AFL.
- The long strike by metal miners against 16 companies in the Coeur D'Alene, Idaho district was also a battleground for two competing unions—Mine-Mill and the Steelworkers. During the strike, the steel union attempted to woo over the striking miners with the pledge to win a good contract. Mine-Mill countered with a $1,000-a-week contribution to the miners, with an additional appeal to its locals to help out. These moves help to keep the strike going.

COMMUNIST LABOR CRACK-DOWN ADVANCES: Justice Department has followed up its efforts to disband Mine-Mill as bargaining representative with identical action against the left-wing independent Electrical Workers Union. Attorney General Brownell appealed to the Subversive Activities Control Board to find the electrical union Communist-infiltrated.

Result of this move means added pressure on Mine-Mill. It means the Board must step up its hearings against the mine union to keep abreast of its agenda.

Quaker

Specially made heavy duty belt takes tough shock impacts

A dependable, money-saving supply source! That's your Quaker-Quaker Pioneer distributor. He can save you inventory expense, storage and freight charges, costly delays. Look him up in the classified phone book—or write to us and we'll send you his name together with free brochure on belting.

Put uninterrupted carrying between primary crusher and storage bins with this belt, specially engineered to stand up to the rugged punishing wear of ore conveying. Tough cover withstands shock impact of jagged loads and gives extra safety against the wearing effects of material caught between boot pulley and belt. Highly resistant to the flexing of short centers and the tension of long hauls. Made of rugged, durable duck. Also available with nylon, cotton or rayon with nylon breaker strips for impact resistance. Skin coat between plies. Mildew resistant throughout. Any lengths and up to 72″ widths. Complete Quaker-Quaker Pioneer line also includes hose, packing and moulded rubber for every use.

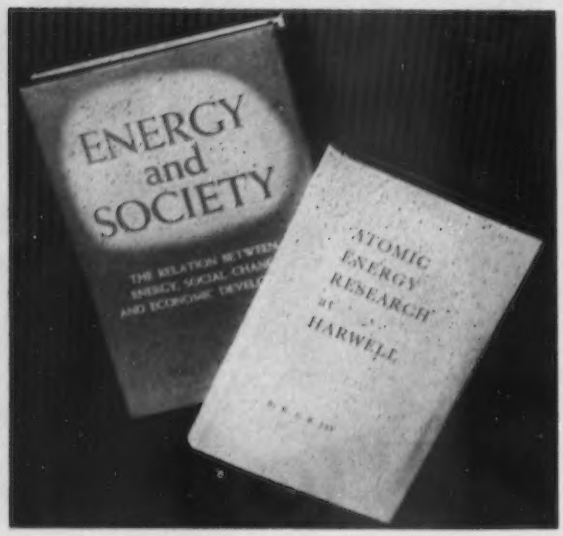
DIVISIONS OF HKP H. K. PORTER COMPANY, INC.

H. K. PORTER COMPANY, INC.

QUAKER RUBBER DIVISION
Philadelphia 24, Pa.

QUAKER PIONEER RUBBER DIVISION
San Francisco 7, California

NEW BOOKS



Energy and Society, the Relation Between Energy, Social Change and Economic Development, by Fred Cottrell. Text book. Rather dull-explanation-type at the start, but reading the last chapter first gets the book off on the right foot. Author traces the growth of civilization with an energy yardstick, rather than Toinbee's spiral of civilization technque. Social impact of any increase in technology is developed, first in a simple society and later in complex organizations. High energy demands for survival alone, may preclude any advancement in living standards.

Mr. Cottrell discusses the cold war, Point Four and Marshall Plan and whether you agree with his thesis or not, *Energy and Society* will stimulate your thinking on the present cold war problems. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 323 pp. Price $6.

Atomic Energy Research at Harwell, by K. E. B. Jay. Book carries forth the United Kingdom Atomic Energy Authority program from point of departure in previous book. *Harwell—the British Atomic Energy Research Establishment,* up to August 1954. It describes the work done at Harwell between 1951 and 1954, and contains details on some projects that were discussed in general terms in the earlier book. Published by the Philosophical Library Inc., 15 East 40th St., New York 16, N. Y. 19 half-tones and 143 pp. Price $4.75.

Canadian Trade Index, 1955. Annual volume prepared by Canadian Manufacturers Association, 67 Yonge St., Toronto 1, Ontario. In English with cross reference index in French. Also available in a limited edition for South America in Spanish and Portuguese. Contains more than 10,000 manufacturers with address, branches, principal products, export representation, brands and trade marks, classified directory of products made in Canada. Also has section on export methods and services. 1,100 pp. Price $7.50.

Bibliographical Survey of Corrosion, 1950-51, by National Association of Corrosion Engineers, 1061 M&M Building, Houston 2, Texas. Preceding three volumes covered 1945-46 and some 7,960 abstracts. This issue contains 4,454 abstracts of some 500 periodicals and books from 30 abstracting agencies. 402 pp. Price, NACE members $10, non-members $12.

Hydraulic Operations and Control of Machines, by Ian McNeil. Published by Ronald Press Co., 15 E. 26th St., New York 10, N. Y. 316 pp. Price $7.50.

Infrared, a Library of Congress Bibliography, PB 111643. All references on the subject from 1935 to 1951. Can be obtained from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. 374 pp. Price $3.

Canadian Mines Handbook, 1955. Published by the Northern Miner Press, Ltd., 116 Richmond St. West, Toronto, Ontario. Principle companies, inactive and extinct groups, metal mines classified and mining stock prices covered. 986 Active companies and 7,200 others. 351 pp. Price $3.

Pick's Currency Yearbook, 1955, by Franz Pick. Published by Pick's World Currency Report, New York 6, N. Y.

Die Erzlager des Rammelsberges bei Goslar, von Emil Kraume mit Beiträgen von Fritz Dahlgrün, Paul Ramdohr and Albrecht Wilke. Monographien der Deutschen Blei-Zink-Erzlagerstätten. Geologischen Landesanstalten der Bundesrepublik Deutschland, Hannover Beiheft 18. 394 Seiten stark. Preis DM 40.

Streckenausbau in Stahl, ein Handbuch fur die Praxis, von Fritz Spruth. Zimmerung und Schachtverschalungs Praxis in deutschen Kohlenbergwerken. Besonders hervorgehoben wird die richtige Anwendung and Ausnutzung von Bergwerkstraegern und Stuetzungen. Verlag Gluckauf, GMBH, Essen. 215 Seiten stark, mit vielen Photographien. Preis is unbekannt.

All correspondence for back issues of *E&MJ*, not current, should be addressed to . . . Back Issue Corp., 16 E. 46th St., New York 17, N. Y. or to the warehouse at 805 Mamaroneck Ave., Mamaroneck, N. Y.

Exploración Geofísica, Levantamiento Magnetométrico, por W. B. Agos para la Aero Service Corp., folleto de 15 páginas que trata de la teoría y práctica del magnetómetro desde el aire con una interpretación de los resultados. Se ofrece gratis a los técnicos que se interesen, previa solicitud. Diríjanse a Aero Service Corp., 210 E. Courtland St., Philadelphia 20, Pa. 15 pgs. Gratis.

Minerals Yearbook, 1952, Metals and Minerals (except fuels), Volume I. Annual publication of the Interior Department, U. S. Bureau of Mines, Minerals Division. 1188 pp. Can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $4.

Report of Investigation 3, Geology of the Jervis and Yankalilla Military Sheets, by B. Campana, R. B. Wilson and A. W. G. Whittle for the Department of Mines, South Australia Geological Survey, Department of Mines, 31 Flinders St., Adelaide, Australia. An explanation of the geological maps. Maps and 26 pp.

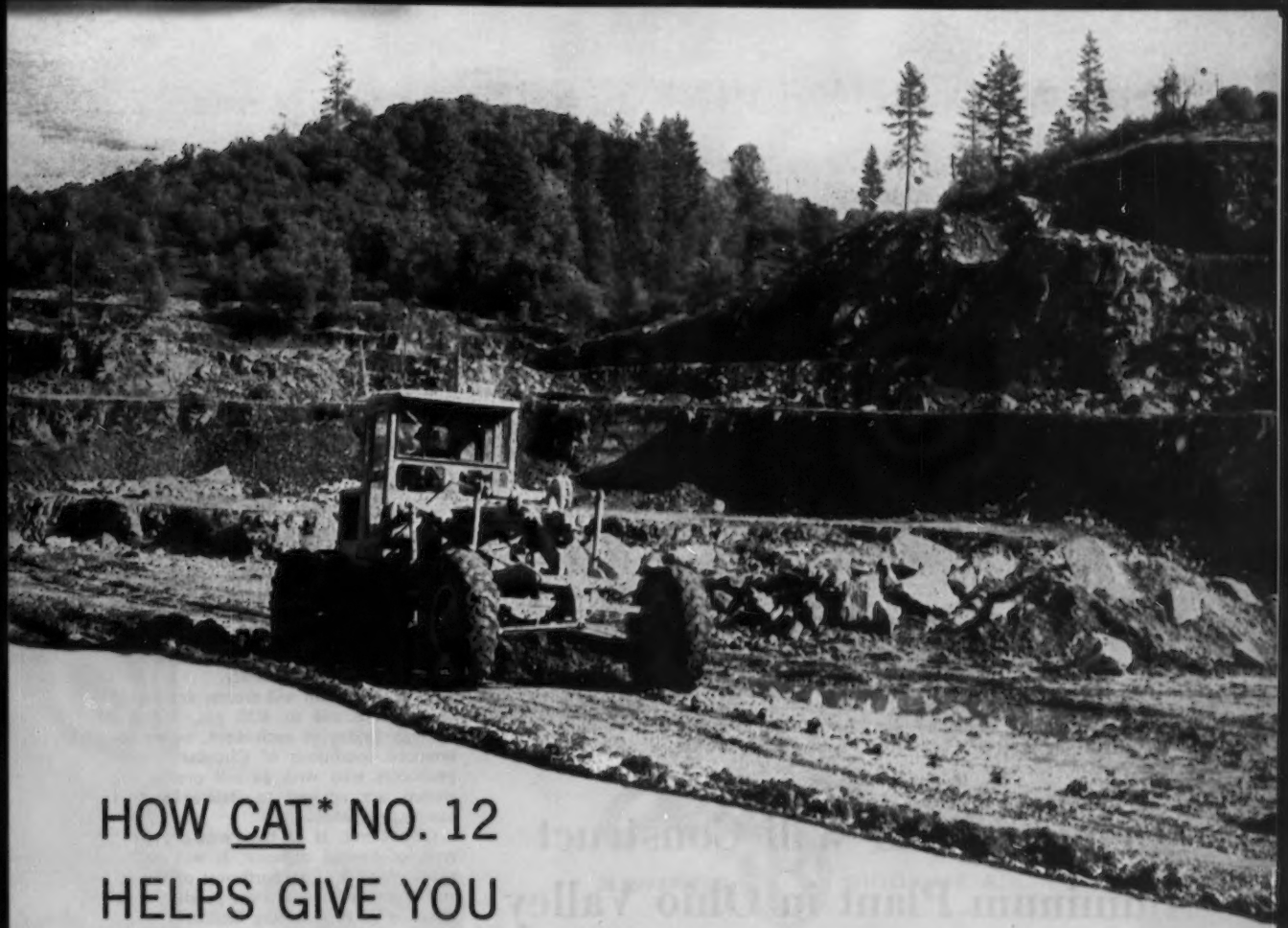
Report of Investigation 4, Geology of the Gawler Military Sheet, by B. Campana, M. F. Glaessner and A. W. G. Whittle. Department of Mines, South Australia Geological Survey, Department of Mines, 31 Flinders St., Adelaide, Australia. Color plates and 24 pp. and map.

Los Problemas Juridicos y Economicos de la Mineria del Azufre, en relacion con los de la Industria Minero-Metalurgica Mexicana. Lic. Alberto Terrones Benitez, Senador por el Estado de Durango. Primera Comision de Minas, Mexico 1, D. F.

Prospecting for Radioactive Minerals in New Zealand, by L. I. Grange for New Zealand Geological Survey. Admirable little pamphlet on radioactive potential of North and South Islands. Included chapter on how to make your own geiger counter. Author concludes that while no major indications of thorium or uranium were found, the area has excellent potential. Colored maps of both islands and 28 pp. Price unknown.

Records of the Geological Survey of Tanganyika, Vol. II, 1952. Covers geology of part of upper Lupa River Valley, North Pare area, Northwest Ulanga district and makes comparative notes on the graphite-bearing rock of Tanganyika and those of Madagascar. Printed for the Survey by Government Printer, Dar Es Salaam, Tanganyika. 66 pp. Price 7/50.

North Dakota Geological Survey Report of Investigation 19, by Albert G. Opp. Magnetometer Survey of Keene Dome, McKenzie County. Text and map on one page.



HOW CAT* NO. 12 HELPS GIVE YOU "LOWER COST PER TON"

OUT IN San Andreas, Calif., this Caterpillar No. 12 Motor Grader works eight hours a day, five days a week, the year around. It maintains haul roads and plant roads around the limestone quarry of Calaveras Cement Co. Plant manager Grant W. Metzger says, "We like the dependability of the machine and its ease of maintenance. Cat equipment gives us lower cost per ton."

Like all Caterpillar Motor Graders, the No. 12 is a balanced unit, built—not merely assembled—by a single manufacturer. Engine, blade capacity and working speed are carefully matched for maximum efficiency.

In addition to traditional Caterpillar ruggedness and freedom from down time, the No. 12 now has important new features for even higher production at lower cost on *your* operation:

NOW—TUBELESS TIRES. Available at no extra cost, they eliminate an estimated 80% of down time caused by tires. Tubeless tires are easier and quicker to mount, hold air longer, run cooler, and give better puncture and blowout protection.

MONEY-SAVING OIL CLUTCH. Special cork facings are bathed in oil for cooler operation, less fade, longer life. Facings wear an average of only 2½ thousandths of an inch per 1000 hours of operation; can give you 1500 hours without clutch adjustment.

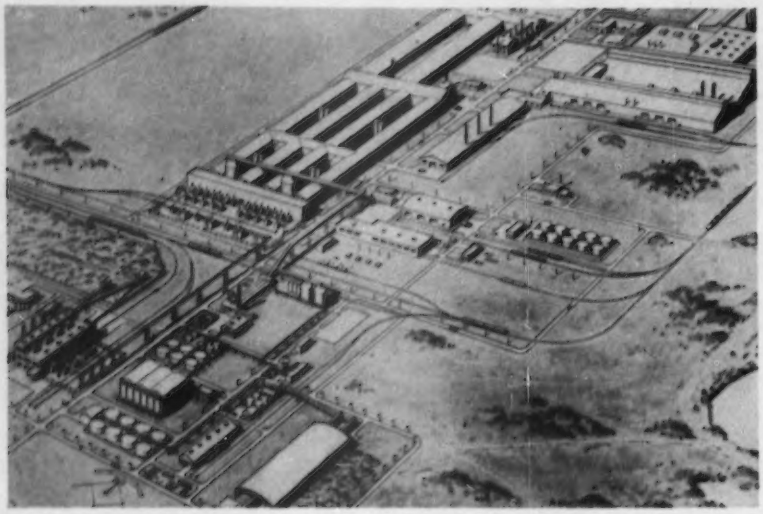
Your Caterpillar Dealer is a *single reliable source* for skilled service and factory parts. Call him today for a demonstration of the Caterpillar Motor Grader —No. 12, No. 112 or No. 212—that will do most work for *you* at lowest cost.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co

99% OF ALL CAT MOTOR GRADERS ARE STILL IN USE



DUE IN 1958: Olin Mathieson's aluminum project at Clarington, Ohio, will produce some 60,000 tons metal per year. Refining plant (bottom left) will produce alumina from Surinam bauxite; reduction plant (center) will supply metal to rolling mill for fabricating sheet and strip (top). Power plant, coal mine are upriver.

Chemical Firm Will Construct Aluminum Plant in Ohio Valley

OLIN MATHIESON CHEMICAL CORP. will build a $120-million, 230,000-ton annual capacity alumina plant on the Ohio River near Clarington, O. Included in the operation will be a reduction plant, fabrication mill, power plant and a new coal mine, the latter two to be situated 11 miles up the Ohio near Cresap Bottom.

Thomas S. Nichols, president of the chemical firm, noted that, initially, annual output needed for the reduction plant will be only 115,000 tons alumina and that the surplus will be sold on the open market. Production target for the facility is mid-1958.

Power plant, on the West Virginia side of the river, will consist of two units, one owned by the Ohio Power Co., the other by Cresap Generating Corp., owned jointly by Olin Mathieson and Pittsburgh Consolidation Coal Co. It is "Pitt Consol" which will open a new underground coal mine at the site to supply fuel for the two 225,000 kw units. A high tension transmission line will connect the operations with the aluminum layout. Plant will be designed for 1.35-million kw capacity. Initial coal requirements are set at about 2-million tons per year.

Aluminum output from the plant will be some 60,000 tons per year, with most of the output going directly to the metals division of Olin Mathieson. However, officials point out, the firm will be both a buyer and seller of prime aluminum in order to keep the fabricating facilities in balanced supply.

Bauxite for the operation will be delivered from Billiton Co.'s mines in Surinam via ship to Baltimore and rail to Ohio. First shipments for stockpile at the refinery are due in early 1957. Along with the refinery for alumina output and the reduction plant for metal, a rolling mill will produce sheet and strip. A foil mill is also being considered.

Finalization of plans is a product of more than four years research by the firms involved. Olin Mathieson received a Government certificate of necessity in 1952, granting rapid tax amortization privileges, receiving subsequent approvals over the four-year period. Firm was among the last whose application was approved by ODM.

Mallinckrodt Signs New Uranium Refining Pact

ATOMIC ENERGY COMMISSION and Mallinckrodt Chemical Works have signed a new four-year contract for operation of two AEC metal producing plants in the St. Louis area, according to S. R. Sapirie, manager of Oak Ridge.

The chemical firm will be paid on a cost-plus-fee basis, with Government providing all working capital. The fee at present will be about $500,000 per year, but will be increased to about $780,000 per year when Mallinckrodt takes over operation of a new plant being constructed at the Weldon Springs ordnance works, about 25 miles south of St. Louis.

In early January, AEC chairman Lewis L. Strauss announced a program to encourage private industry to build and operate plants for the chemical processing of irradiated fuel elements from research and power reactors, as "a further step toward private ownership of atomic energy facilities for peaceful uses."

Two New Ore-Buying Sites Planned in the Southwest

GRAND JUNCTION Operations Office of the AEC has announced plans to open two new ore-buying stations for uranium, one at Tuba City, Ariz., and another at Grants, N. M., to go into operation Feb. 1 and April 1, respectively.

Tuba City plant will receive acceptable ore from 8 am to 4:30 pm, Monday through Friday of each week, under announced conditions of Circular 5. Ore producers who wish to sell ore to the station are advised to deliver a trial sample for processing.

Grants mill is of the "semi-portable" type, of limited capacity. It will be located about 3 miles northwest of Grants and will handle area ores pending construction of new milling facilities.

New Tuba City sampling plant was constructed and is owned by Rare Metals Corp. of America and is leased to the AEC pending completion of new mill, to be built by the firm, on the Navajo Indian Reservation, 75 miles north of Flagstaff. After completion of the uranium mill, scheduled for this summer, Rare Metals will take over the sampling plant to purchase for their own account.

American Lithium Begins Output at San Antonio

AMERICAN LITHIUM CORP., subsidiary of American Potash & Chemicals Corp. and Bikita Minerals, South Africa, went on stream late in December at their $6.6-million lithium chemicals plant at San Antonio, Tex.

Plant utilizes a version of the alkaline leach process for spodumene, but American Lithium uses lepidolite from the Bikita open pits. (*E&MJ*, September 1955, p 75.) According to the firm lepidolite is easier to work with, requires lower kiln temperatures; but calls for an extremely high concentration of alkalis in the leach product.

American Metals Co. is also a part owner in the project and holds an interest in Bikita. American Potash produces lithium and other products at its Searles Lake facility at Trona, Calif., where it extracts them from lake brines.

(Continued on p 162)

You get your money's worth
when you buy O-B shells and plugs!

You buy more than high-strength anchors when you buy O-B shells and plugs for roof support!

You buy a fast bolting cycle, too, because these O-B units are easy to work with. They go on the bolt fast—no delays due to off-size threads. • They go up the hole fast—no hanging up half-way. • They tighten up fast—no falling out of the hole before tightening, no slipping or spinning in the hole during tightening. • They hold fast—four-way expansion of shell creates a powerful "socket" anchorage that's solidly backed up with heavy metal of the plug.

If you want a high-strength anchor and a fast bolting cycle, too, try these O-B shells and plugs now.

Ohio Brass

MANSFIELD OHIO, U. S. A.

4593-M

Feeder and Trolley Materials • Control Materials • Trolley Shoes
Roof Bolt Shells and Plugs • Rail Bonds • Automatic Couplers

BAIL TYPE
5/8" 22463
3/4" 22378

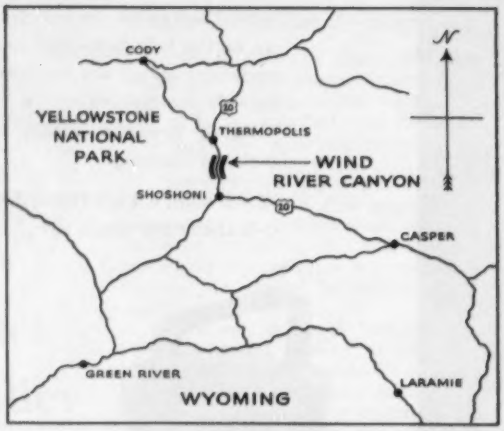
STANDARD
5/8" 21890
3/4" 21889

'I've never hit a tougher rock job in my 28 years in these mountains'

DAN RATLIFF, *Superintendent for the Wind River Project Contractors, the* INLAND CONSTRUCTION COMPANY

ATLAS COPCO DRILLS DRIVE THROUGH SOLID ROCK ON WIND RIVER CANYON HIGHWAY, WYOMING

Wind River Canyon is eleven miles long; a principal route to the Yellowstone National Park. Cut out of the precipitous canyon walls over six-thousand feet high is a railroad and a twenty-year-old highway packed with tourist traffic during summer. To ease congestion and to eliminate danger spots on the highway, Wyoming's State Highway Department decided to carry out extensive modifications.



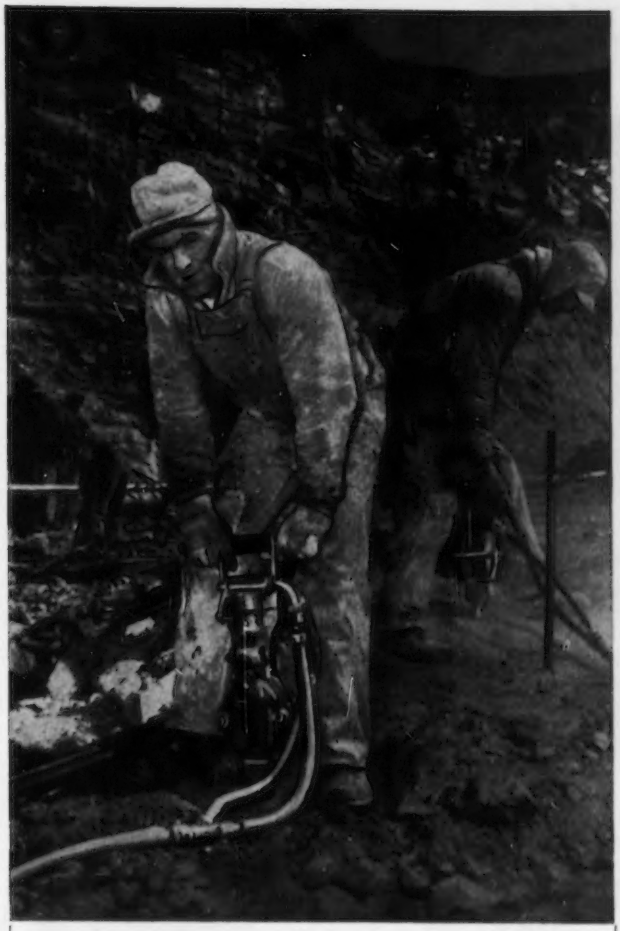
ATLAS COPCO BREAK NEW GROUND

Rock work was a major part of the project, with 200,000 cubic yards excavated for dumping. The maximum cuts, 1,000 feet long, 95 feet deep and 60 feet wide, were in areas of solid rock; a conglomerate of diorite, red granite and badly fissured sandstone and limestone. This was the type of ground once kept for the heavy wagon drill. The Inland Construction Company drew on past experience, swept aside convention and chose Atlas Copco light, *one-man* rock drills and Sandvik Coromant integral steels to do the job instead. Their choice gave them rock-drilling equipment costing at least fifty per cent less! The drills and steels were supplied by Atlas Copco Pacific Inc. In spite of solid rock, below-zero temperatures and restricting blasting requirements, Atlas Copco drills and Sandvik Coromant steels once again showed themselves to be the world's leading drilling combination. Their fine performance in Wind River Canyon is indicated in the low figure of 1.15 feet of drilling for each excavated cubic yard of rock. Low powder costs reported from Wind River Canyon can be attributed to the small bit diameter of Sandvik Coromant steels.

UNBEATABLE DRILLING UNIT

Atlas Copco light rock drills and Sandvik Coromant tungsten-carbide-tipped steels started a revolution in the drilling field when introduced some ten years ago. Developed closely together, they make an unbeatable unit.

The Atlas Copco light, one-man rock drill itself is a versatile machine. On Wind River Canyon they were used for benching. With the addition of a pusher leg, any one of them could have been adapted for tunnelling *in minutes.*



Two Atlas Copco light rock drills in operation in Wind River Canyon. Fifteen of these drills excavated 200,000 cubic yards of rock. All were fitted with Sandvik Coromant tungsten-carbide-tipped steels.

EXTRA-TOUGH COROMANT STEELS

Sandvik Coromant steels are extra-tough! You can be sure of a quality that never varies. This is because Sandvik control every phase of production—from the mining of iron ore, processing of wolfram ore to the final tungsten-carbide tips used throughout the world wherever Atlas Copco drills are in action. Wind River Canyon project is another example of how this outstanding combination can bring *new* speeds and *new* economies to drilling—*even under the toughest conditions.*

The Atlas Copco Group puts compressed air to work for the world. It embraces thirty-one Atlas Copco companies and twenty-four agents, manufacturing or selling and servicing Atlas Copco equipment in more than 50 countries throughout the world.

This Atlas Copco portable grinder was able to service drills on the site; saved drilling delays and overtime costs.

MAIL THIS COUPON *to the most convenient of the addresses given here:*

U.S.A., Atlas Copco Pacific, Inc., 930, Brittan Avenue, San Carlos, California; Atlas Copco Eastern, Inc., P.O. Box 2568, Paterson 2, N.J.; CANADA, Atlas Copco Canada Ltd., Montreal, A.M.F., P.Q.; MEXICO, Atlas Copco Mexicana S.A. Apartado Postal 56, Torreon, Coahuila.

UNITED KINGDOM, Atlas Copco (Great Britain) Ltd., Wembley, Middx.; FRANCE, Atlas Copco France S.A., 29, Rue Marbeuf, Paris 8e; HOLLAND, Atlas Copco Holland N.V., P.O. Box 6056, Rotterdam; ITALY, Atlas Copco Italia, S.p.A., Viale Marche 15, Milan.

AUSTRALIA, Atlas Copco Australia Pty. Ltd., P.O. 54, Auburn, N.S.W.; SOUTH AFRICA, Delfos & Atlas Copco (Pty.) Ltd., P.O. Box 504, Benoni, Transvaal.

Readers in countries outside those listed above and who do not know the name of their local Atlas Copco company or agent, please write to Atlas Copco AB, Stockholm 1, Sweden.

Please forward details of ***Atlas Copco Rock Drills and Sandvik Coromant Drill Steels***

NAME .....

COMPANY .....

ADDRESS .....

.....

*I am also interested in other Atlas Copco equipment (Please state which below)

..... 42/2

** Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment*

THE ATLAS COPCO GROUP OF COMPANIES

THIS MONTH IN MINING *(Continued)*

New Park Mining Reports New Values in Drifting

NEW PARK MINING CO. has confirmed a "remarkable" increase in gold-silver values in a branch of the Pearl Fissure at the company's Park City, Utah district mine.

W. H. H. Cranmer, president, said that the ore in the branch has been averaging 4 to 7 oz gold and up to 75 oz silver.

Values of lead are about 5%; copper, 9%; and zinc, 12%.

The camp is known primarily as a lead-silver-zinc district. Specimen samples of ore from the branch run as high as 34 oz gold and 100 oz silver.

The discovery was made on the 1755-ft level in about 500 ft from the main shaft now being deepened.

Cranmer said that the drift is in more than 200 ft on the Pearl Fissure branch, with the high values maintaining themselves on the last 100 ft.

Two raises are being utilized and three more are under way.

The high grade is believed related to a segment of ore of similar quality found in the main Pearl Fissure on the 1625-ft level, 130 ft above.

The high-grade orebody runs the entire vertical height of the drift in the Pearl branch and is averaging about 2½ ft in width.

Little values are being found on the main Pearl Fissure on the 1775-ft level along the route of the branch.

However, the depositions of sulphides were made in New Park's Pearl Fissure system after the fissure was formed.

In the meantime, station has been completed on the 1880-ft level of the main shaft and drifting eastward has commenced. It will take an estimated three months for this level to be pushed under the Pearl Branch.

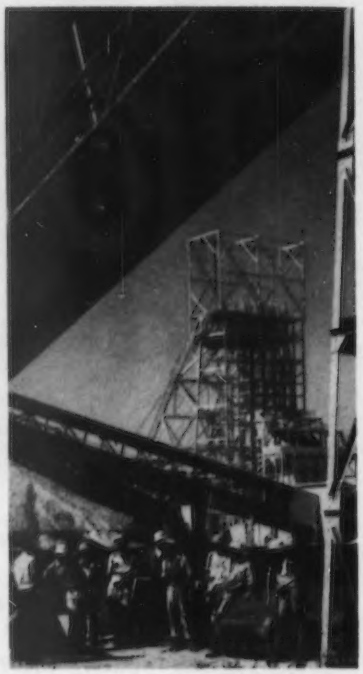
Cranmer said that while the increase in grade is welcome, the importance to him is the fact that high grade copper-gold values have been uncovered in the district at depth.

He has been long an advocate of the theory that the Park City anticline bears a relationship to the Bingham-Lark district in which Kennecott Copper Corp.'s huge open-cut mine is located. Bingham, of course, was an historic gold camp.

In this light, New Park has acquired more than 16 sections of land in the Vallejo area of the Park City district in recent months. The Vallejo was worked in the old days as a shallow copper-gold property.

Meanwhile, New Park is continuing to push its 1755-ft level westward toward anticipated intersection with bedded lead-silver-zinc ores.

Until the high-grade was encountered in the east sector of the property, the bedded ore was regarded as a major geologic bet of the firm now engaged in development work.



ELEVENTH new mine to open in the area, Free State Geduld G. M. was officially brought into production Jan. 6, 1956. Headframe of the new mine is seen through ore conveyors. It was at Free State that the famous 23,000 in.-dwt borehole strike was made. Twelfth new mine will be Merriespruit, which is reported progressing according to schedule.

AEC Announces Increase In Thorium Metal Price

REACTOR-GRADE thorium metal will be sold for use in the yet-to-be-built breeder at the new rate of $43 per kilogram by Atomic Energy Commission, according to January 10th announcement. Old price was $25 per kilo and new level was established according to AEC to stay in line with their policy of full cost recovery and also to interest thorium industrial producers. At the old price, producers could not even make the raw material for metal production.

AEC will continue to supply thorium metal to reactor builders until private industry is ready to take over. First big reactor will not require metal for another year and it will take at least that long to build a commercial metal plant large enough to handle reactor program.

With the approach of a breeder reactor program only a year or two away, AEC has yet to announce a realistic thorium mining, milling and purchasing program, according to industry spokesmen. Conditions under which present industry must operate were the subject of an article in *E&MJ*, October 1955.

Mining Calendar

American Institute of Mining and Metallurgical Engineers, annual meeting, Feb. 20-24, Hotel Statler, New York City.

American Congress on Surveying and Mapping—American Society of Photogrammetry consecutive meetings, Shoreham Hotel, Washington, D. C. March 18-24.

Regional Reactive Metals Conference, Niagara Frontier section, AIME, March 19-21, Buffalo, N. Y.

Symposium on Extraction Metallurgy of some of the Less Common Metals. March 22-23, London, England.

Canadian Institute of Mining and Metallurgy, annual meeting. April 9-11 Quebec City.

Symposium on Rock Mechanics, sponsored by the Colorado School of Mines, Golden, April 23-25.

Institute of Lake Superior Geology, Houghton, Mich., May 11- 2.

Fraudulent Tungsten Ore Sales Checked by GSA.

A PRICE SUPPORT program to insure mining of tungsten ore domestically has been violated according to GSA. Tungsten sellers have sworn false statements that Mexican ore, which sells for the world price of $33 per unit (20 lb) was mined in California or other western states, where a subsidy plan allows $63 per unit.

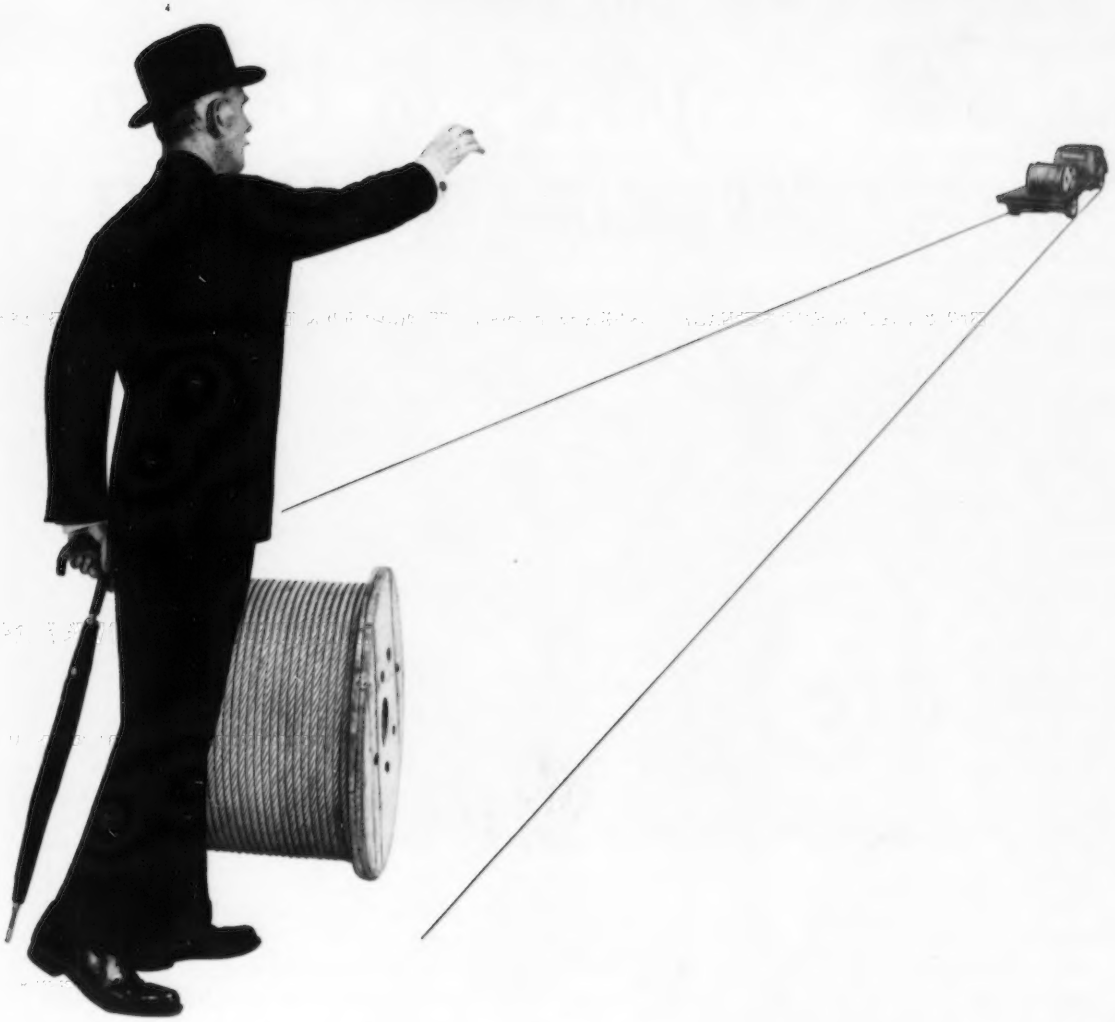
Fraudulent sales of Mexican ore apparently began some 19 months ago when the world price fell below the support price. GSA began checking when a Los Angeles importer of Mexican ore reported his sources appeared to be selling ore illegally. When evidence of fraud was found, the FBI was asked to investigate.

Tungsten ore sellers now must file two certificates; one which they have always signed which states that the ore was mined domestically and a new one which is required if the ore is purchased from a second party. This allows GSA to check all secondary sources.

Selenium Pilot Plant to Work Wyoming Deposits

SHAWANO DEVELOPMENT CORP., one the four principal firms drilling for primary selenium ore in Wyoming, will have a pilot plant in production in mid-May from which they anticipate production of 1,200 to 2,000 lb commercial grade selenium per day. Shawano sets assay of the orebody at about .69% over all, based on drilling and color of the Miocene rock.

Reports to date from USBM's Inter-



YOUR WICKWIRE ROPE DISTRIBUTOR SAVES YOU DOWN TIME

When the lack of the proper wire rope halts your production or your operations, thank your lucky stars that your helpful Wickwire distributor is only a quick phone call away. It's a wonderful feeling...to know you'll be getting exactly what you need from his warehouse stocks in only a few hours time.

Now contrast that with the cost in time, money and inconvenience of emergency shipments direct from a distant manufacturer.

In addition to saving on down time, your Wickwire distributor effects further economies by recommending the wire rope that will give you the longest service life, by minimizing your bookkeeping, inventory maintenance and transportation costs. He keeps your reserve stocks for you so that you don't tie up capital in stand-by materials, warehouse space and unnecessary stock insurance and handling.

Your Wickwire Rope distributor is a good man to know. He's quality people handling quality products. Buy your wire rope and slings from him. You'll find that the many valuable services he offers far outweigh any apparent price advantage you might gain by buying direct.

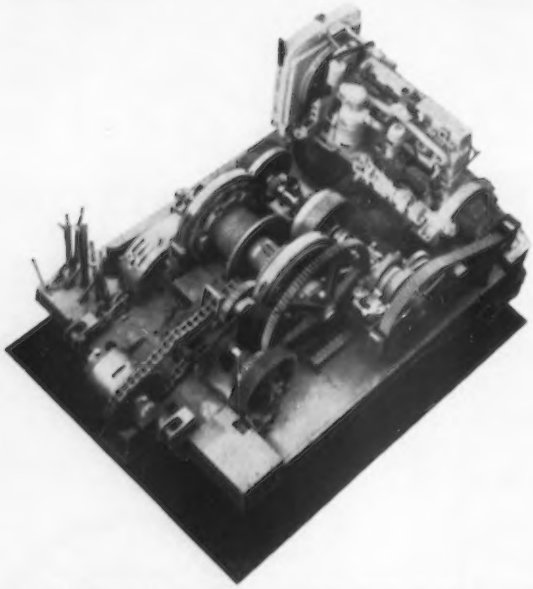
CF&I WICKWIRE ROPE A CF&I PRODUCT

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

3152

BUCYRUS ERIE

Simplicity of Design
SPEEDS SERVICING IN YOUR PIT



Special care is taken to arrange deck machinery on Bucyrus-Erie excavators so it's easy to get at . . . so parts may be simply removed without dismantling other units.

Essential simplicity of design is one of many reasons Bucyrus-Erie excavators are preferred in the pits. It not only boosts output, but keeps maintenance low, machine-life long. One look at the deck machinery of a Bucyrus-Erie will show you how design simplicity makes a big difference in reducing maintenance delays. Parts are large, simple, few in number, easy to get at for replacing. Lubrication fittings are grouped at central, easily-accessible locations. All adjustments, including single-point wear adjustments on clutches and brakes, are easily made and stay put for long periods. Clutch bands are interchangeable and reversible end-for-end to simplify maintenance.

Design simplicity is only one of many Bucyrus-Erie features that add up to a higher percentage of actual working time each shift — and consequently to greater output and profits. Let your nearby Bucyrus-Erie distributor explain *all* of the features that make these machines standouts for output and economy in *your* loading and stripping operations. Ask about the 1½-cu. yd. 38-B (shown here), and about these other popular favorites for mining operations —the 2-yd. 51-B, the 2½-yd. 54-B, the 3-yd. 71-B, and the 4-yd. 88-B. 121E55

BUCYRUS-ERIE COMPANY

South Milwaukee, Wis.

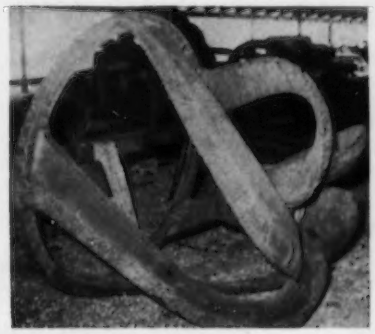
75 Years of Service to Men Who Shape the Earth

HOW TO GET LONGER LIFE AND MORE WORK

from your mining equipment

For over thirty years Stoody Hard-Facing Alloys have been accepted as the standard of wear protection, increasing overall equipment life and maintaining operating efficiency. Hard-facing procedures developed by Stoody are thoroughly field tested and proven under actual working conditions in mines located all over the globe. For all-around dependability and maximum wear resistance, no better hard-surfacing materials are made. Use Stoody and you use the best!

POWER SHOVEL BUCKETS are kept in top condition by applications of Stoody 21. Note use of stringer beads on all wearing surfaces.



DREDGE PARTS such as the cutter head illustrated, as well as impeller hubs and vanes can be prolonged by hard-facing wearing areas. The part above hard-faced with Stoody 21 outlasted 6 unprotected cutter heads.

CRUSHER ROLLS are easier to maintain with the new Stoody Alloy Tubular Wires applied semi-automatically. Welding is several times faster than with manual electrodes, depositing 7 to 15 pounds of metal per hour.

DIAMOND CORE DRILLING EQUIPMENT including core barrels, flutes and reamers produce more hole when protected with Acetylene Tube Borium. Footage of typical sampling drills was increased from 400-500 feet to 2000-3000 feet in one drilling operation.

CRUSHER JAWS are most efficiently rebuilt with Stoody Manganese and corrugations hard-faced with Stoody 100—both materials are available in the new Stoody Alloy Tubular Wires for semi-automatic welding.

SWING HAMMERS such as this soon lose corners and edges from severe impact and abrasion. Rebuilt with Stoody Nickel Manganese and topped off with a final pass of Stoody 21, life is increased 2 or more times.

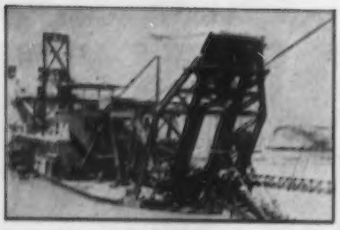
You'll find the Stoody Guidebook chock full of ideas for prolonging life of fast wearing mining equipment by hard-facing. Ask your Stoody Dealer for a copy or write direct!

STOODY COMPANY

11940, East Slauson Avenue

Whittier, California

See the STOODY EXHIBIT—WELDING SHOW, Buffalo, N.Y., May 9-11.



M-8 jig developed by YUBA for concentrating ores on dredges and in mills. It's designed to save space, reduce downtime, increase production.

FULL AREA OF

YUBA JIG BED

IS COMPLETELY ACTIVATED

YUBA jig action is positive. You set the speed and stroke wanted, get constant, even pulsations that create surface action over full area of bed. Result: YUBA M-8 jigs have a large material capacity per flow line under full control.

Any material that can be concentrated can be handled successfully in YUBA jigs, including . . .

CASSITERITE	RUTILE
GOLD	SCHEELITE
PLATINUM, ETC.	GARNETS
MONAZITE	SAPPHIRES
ZIRCONIUM	IRON
ILMENITE	COPPER

Design Eliminates Trouble Spots

Stainless steel hutch valves and screens prevent rusting and clogging. Rubber seal between screen grids and basket confines action to screen area. Long-wearing hutch diaphragms of reinforced synthetic rubber can be replaced easily.

"Package Drive" units for YUBA jigs are interchangeable, completely enclosed, self-lubricating. Generous use of antifriction bearings reduces power required. Maximum frequency of a 4-cell M-8 jig is 350 at ¼". Stroke adjustments between ¼" minimum and 3" maximum are easily and quickly made, enabling you to closely control jig action.

YUBA jigs can be installed in new or old dredges or mills to supplement existing jigs or to replace other concentration methods. Send us data on ore, feed sizes and present installation if you wish us to furnish details to adapt YUBA jigs to your operation.

71R

YUBA MANUFACTURING CO.

Room 600, 351 California St., San Francisco 4, California, U. S. A.

AGENTS { SIME, DARBY & CO., LTD. · SINGAPORE, KUALA LUMPUR, PENANG. SHAW DARBY & CO., LTD., 14 & 19 LEADENHALL ST., LONDON, E. C. 3.

CABLES: YUBAMAN, SAN FRANCISCO · SHAWDARBCO, LONDON

Selenium *(Continued)*

mountain Experiment Station at Salt Lake are that none of the firms exploring the area have so far found "commercial" deposits. However, Shawano feels that construction of a pilot plant is worth the gamble with the price per pound of selenium now at $13. Other mining companies interested in the deposits in the Gas Hills and Baggs areas include Lucky Mc Uranium Corp., Vitro Minerals Corp. and Kerr McGee Oil Industries, Inc. (*E&MJ*, December 1955, p 116.)

Shawano will build its pilot plant as an adjunct to a uranium up-grading mill in the Poison Basin area.

DMEA Has Executed 847 Exploration Contracts

WITH THE ADDITION of eight contracts for mineral exploration in November 1955, Defense Minerals Exploration Administration brought the total since the beginning of the program to 847. In addition to the eight, eleven others were approved by DMEA during the month but were pending execution by the applicants.

As of the end of November, the agency had received 2,893 applications with 1,330 denied, 522 withdrawn and 194 still being processed. Maximum Government participation in the new contracts was $161,902.50.

Breakdown of the executions by mineral were: for copper-lead in Butte County, Idaho; for tungsten and for mica (3) in North Carolina; for tungsten in White Pine County, Nev.; mercury-uranium in Presidio County, Tex.; and for uranium in San Juan County, Utah.

Rhodesian Copper Schedules Refinery Expansion Scheme

REFINERY CAPACITY will be increased by some 7,500 tons of copper per month at the Nkana refinery of Rhodesian Copper, bringing total capacity to some 23,000 tons.

Expansion program, to cost £5-million, includes installation of a 350-ton reverberatory furnace and auxiliary equipment. New furnace will be housed in an extension of the present building and will require construction of eight extra bays and an additional 144 ft in length of the structure. Target date for completion of the new facility is less than 20 months away.

Estimate $700-Million Was Spent for Stockpile in '55

NATIONAL STRATEGIC STOCKPILE will serve the U. S. as a reservoir of vital raw materials both for a wartime effort and equally for the rebuilding of an economy should the nation be attacked, according to Dr. Arthur S. Flemming, director of ODM. Flemming noted that better than $5-billion has already been spent to fill the stockpile and that another $5-billion is planned.

During 1955, the Government spent an

J. L. McCune & H. E. Sadler, underground maintenance foremen, Pacific Coast Borax Co., Boron, California

"Red Line 350 Oil...life blood of these machines"

"Union's Red Line 350 Oil performs so well in the hydraulic systems of our Joy continuous miners and shuttle buggies that we hardly ever think about it except to keep the levels up.

"In the four years that we've been using Red Line 350 we've never had it 'boil over' or fail in any other way despite extremely heavy work loads and ever-present dust. Because the operation is entirely dependent upon properly functioning hydraulic mechanisms you might say that Red Line 350 Oil is the life blood of these machines."

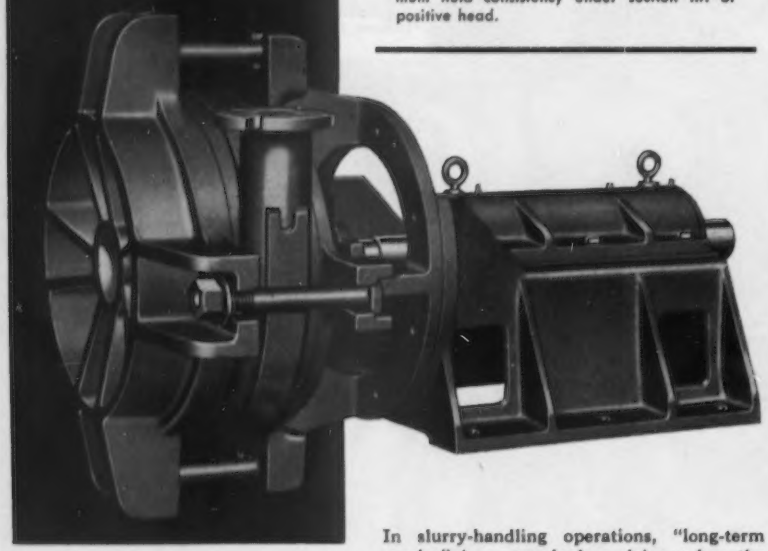
The job that Red Line 350 Oil is doing in the Joy machines at Boron is typical of the service that Union Oil lubricants give in mining machinery above and below ground. If you need help with any specialized problem of mining machinery lubrication, you can get that help through your nearby Union Oil representative.

UNION OIL COMPANY 76
OF CALIFORNIA

Los Angeles: Union Oil Bldg. • **New York:** 45 Rockefeller Plaza • **Chicago:** 1612 Bankers Bldg. • **New Orleans:** 644 National Bank of Commerce Bldg. **Dallas:** 313 Fidelity Union Life Bldg. • **Kansas City, Mo.:** 612 W. 47th St.

For Continuous Heavy-Duty Pumping

The Morris Type RX Pump shown below is a heavy-duty, low-speed all metal slurry pump expressly designed to handle abrasive slurries, chemical sludges, plant wastes etc. up to maximum fluid consistency under suction lift or positive head.



In slurry-handling operations, "long-term service" is a meaningless claim unless the pump will work day-in and day-out with a minimum of maintenance time, trouble and expense.

Morris Slurry Pumps—with an established reputation for longer life—also incorporate in their design exclusive features which result in easier installation . . . fewer interruptions to service . . . less overhaul . . . fewer replacements.

To Provide Uninterrupted Service...

The gland is under suction pressure only. This reduces leakage and dilution . . . keeps harsh abrasives out of the stuffing box . . . practically eliminates packing troubles.

There are no internal studs or bolts. Caustic and corrosive solutions cannot seep past threads and cause maintenance headaches.

Impeller removed without disturbing the piping. You simply loosen 4 outside clamping bolts and pull off the end cover. This feature alone saves considerable time and labor.

MORRIS
TYPE RX SLURRY PUMP

• Free Service. Morris Engineers will be glad to recommend the pump best suited to your needs for size, capacity, etc. Send necessary data today . . . include request for Bulletin 185.

MORRIS CENTRIFUGAL PUMPS

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Sales Offices in Principal Cities

Stockpile *(Continued)*

estimated $700-million, according to the *New York Times*, which published Dr. Flemming's statement, and will spend $500 to $600-million in 1956, according to the newspaper's assay of some "educated guesses." Major part of the money spent in 1955, says the article, was spent on stocks of tungsten, nickel, tin and manganese.

Chile Approves Anaconda's Expansion Plans at Chuqui

PRESIDENT IBANEZ of Chile has signed a decree which authorizes the Anaconda Co. to invest some $38-million in machinery and equipment to expand its Chuquimata mine plant. Of this amount, some $21-million will go toward modernization and expansion of the sulphide plant and the remainder for construction of new towns and homes for the company's employees.

Anaconda's Chilean mines produced approximately 220,000 metric tons of electrolytic and blister copper in 1955. It is estimated that, with extension of the installations, production will increase by some 45,000 tons per year.

IM&CC Project Will Double Output of Bonnie Facility

PRODUCTION CAPACITY will be nearly doubled at International Minerals & Chemical Corp.'s Bonnie plant when an expansion program to construct a second sulphuric acid plant and step up neutralization and recovery of plant effluents is completed.

Louis M. Ware, president of the firm, said $4-million will be spent initially on the project, which will permit Bonnie "to produce 500,000 tons of product annually". The plant is the major unit of the corporation's Phosphate Chemicals Division, which manufactures triple superphosphate and feed grade dicalcium phosphate.

Mestersvig Begins Mining

ANNUAL PRODUCTION of 18,000 tons of lead and zinc concentrate is expected this month from Mestersvig mine, Greenland, where the entire mining plant is confined inside rock (*E&MJ*, July 1955, p 128). Ore ships are expected at the coast port in August to load the first six months' production. Shipping is possible only during August-September. Cost to date is $4.1-million.

New Spirit in Australia's "Golden Mile" is Created

COMPLETION of many of the arrangements which have resulted in creation of the Gold Mines of Kalgoorlie (Aust.) Ltd. were noted in December by a special fete for the staff of the new company conducted by the management.

The "Golden Mile," famous for its Perseverance, South Kalgurli Oroya

GM DIESEL
CASE HISTORY No. 556-188

OWNER: Badgett Mine Stripping Corporation, Madisonville, Ky.

INSTALLATION: GM "6-110" Diesel-powered Bucyrus-Erie 3-yard shovel loading fleet of GM Diesel-powered Euclid rear dumps on Pennsylvania Turnpike extension project.

PERFORMANCE: Partner Brown Badgett says GM Diesels are "doing a wonderful job." He's running his shovel 10 hours a day, plans to start 24-hour operation soon.

"Doing a Wonderful Job"

FEW WOULD expect to find a mine-stripping contractor on a road-building job. However, where there's dirt and rock to be moved in a hurry it is *not* unusual to find a General Motors Detroit Diesel-powered excavator. The faster, livelier crowd and swing of a "Jimmy" powered shovel means more yards per day at a lower cost per yard.

Principal reason for this snappy action is that a GM 2-cycle Detroit Diesel delivers power on *every* piston downstroke—not on every *other* downstroke as in 4-cycle engines. That means faster acceleration, instant response to throttle demands, real "go" when the bucket takes a bite.

And a GM Detroit Diesel costs less to maintain, too. Valves cost up to 62% less, cylinder liners cost up to 40% less, than similar parts for other Diesels.

More than 150 different manufacturers pick GM Detroit Diesel power for over 1,000 different applications of equipment they build. Your GM Detroit Diesel distributor can give you the list plus full information on GM Detroit Diesel engines. See him today or write direct.

DETROIT DIESEL

ENGINE DIVISION OF GENERAL MOTORS

America's Largest Builder of Diesel Engines

Single Engines . . . 30 to 300 H. P. Multiple Units . . . Up to 893 H.P.

Golden Mile *(Continued)*

Brownhill and Hainault mines, now is the site of the merged operation, which has breathed new life and spirit into the Western Australia district.

A few short months ago, production was about 13,000 tons per month; now with the almost lightning-quick mergers, throughput has jumped to 38,000 to 40,000, and GMK is a major producer.

Apex Increasing Capacity

APEX SMELTING CO., one of the nation's largest smelters and alloyers of aluminum, started construction on the second stage of its California smelting plant in Los Angeles in December. It will double the capacity of the plant.

Louis Lippa, president, announced that initial work was under way for an addition to the plant, with completion scheduled for early 1956.

Norwegian Aluminum

INDUSTRIAL AFFAIRS Committee of the Norwegian Parliament has approved plans to increase aluminum production at the state-owned Ardal plant by 36,000 tons to 62,000 tons annually. Costs, including expansion of hydroelectric power are about £19.7-million.

AEC Offers Uranium Scrap Recovery Plan to Industry

AEC has invited private industry to participate in uranium recovery through processing of fluoride scrap from feed materials plants. Commission also noted that fluoride for commercial use would also be a product.

The uranium and fluoride compounds are contained in process scrap from production plants which convert uranium ores and concentrates into compounds, salts and metals. AEC estimates some 4,000 to 8,000 tons scrap will be available each year. Invitation for bids by the Commission, under which the uranium recovered will be returned to AEC, are expected within nine months.

Thoroughbreds for your string!

SPANG

BLAST HOLE BITS and STEMS

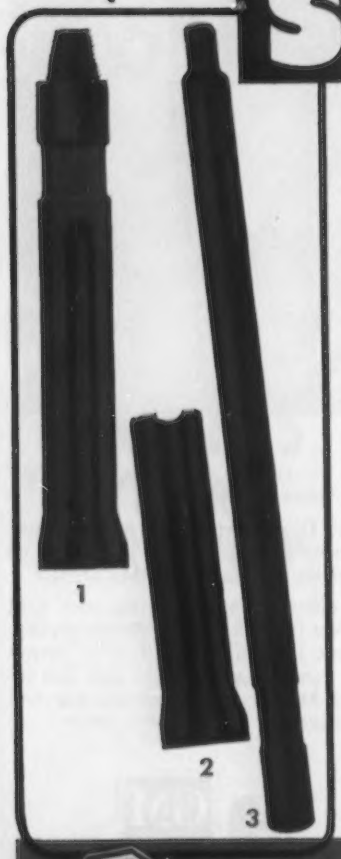
Sure winners in performance and production! Spang Bits and Stems, developed by skilled experts, are a safe bet to pace the field in long service and economy. Win, place or show you can be sure with Spang.

① SPANG CHURN DRILL BITS drill more holes per bit at lower cost! Fully heat-treated, high carbon, molloy steel, or 4340 steel. They have added strength in pin and blade sections to enable them to take the toughest drilling conditions in stride. Semi-dressed ends speed finish-dressing.

② SPANG REPLACEMENT BLADE SECTIONS are for welding to the pin and collar sections of the original bit when it has become worn from long service.

③ SPANG INTEGRAL ROPE SOCKET TYPE STEMS with heat treated swivel socket and swivel. Drill more . . . drill longer for less with these rugged, efficient stems. Made from one bar of steel with only a threaded box joint with integral rope socket top the stem's uniformity cuts vibration or whipping. Tools turn freely in the open swivel socket keeping the hole round and straight.

Your inquiries are welcome— contact your nearest Spang dealer or write direct to:



The HIGHER STANDARD

SPANG & COMPANY

DEPT. M-2 BUTLER, PENNSYLVANIA

For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.

IN THE U. S.

ALASKA

Total value of mineral production in Alaska during 1954 rose to $26-million. In 1954, gold was again in the lead among the Territories mineral commodities in output value. Coal ranked second, close to gold, with sand and gravel third. Output of these three commodities accounted for 89% of Alaska's mineral output in 1954.

Three DMEA contracts were left for exploration at two tungsten and one copper mine, according to W. H. Kerns, U. S. Bureau of Mines in his just-released 1954 Alaska report.

PUERTO RICO

Value of mineral production in 1954 was $13.2-million according to Worna G. Diamond, U. S. Bureau of Mines. Clay, salt, sand and gravel increased in output over 1953, while cement, lime and stone dropped slightly. These were the only commodities mined.

ARIZONA

Mineral production and development reached new records in 1955.

Yield of the state's five major metals —copper, lead, zinc, gold and silver— was valued at $359,730,960.

Figures not yet available for lesser minerals, including uranium—but which had a $17,440,400 value in 1954— should push the total close to the $400-million mark, according to Roger Manning, director of the state department of mineral resources.

In 1954, total value of minerals production was $239,974,000.

Arizona's copper production, 455,000 tons, was the greatest in history and showed a 20.66% gain over 1954's 377,927 tons. The production kept Arizona in first place for copper in the U. S.—a rank it has held since 1910.

Part of the gross value increase was

In Minnesota . . . And the World Over

BUCYRUS-ERIE WARD LEONARD ELECTRIC SHOVELS

Help Put The Lid On Rising Costs

This Bucyrus-Erie 190-B shovel is stripping overburden in a Minnesota iron mine.

In every design and construction feature Bucyrus-Erie Ward Leonard electric shovels are built to save you money. They have the capacity and performance ability to deliver high output at an economical cost per yard.

Modern front-end design eliminates dead weight, lets power work effectively swinging payloads. Boom strength is greatest where it's needed most to withstand digging and swinging stresses. Ward Leonard control results in fast acceleration and deceleration, provides extra torque and ample usable power. Heavy-duty construction keeps maintenance costs down and adds years to machine life.

All over the world — in mines, in quarries, and on big construction projects — Bucyrus-Erie Ward Leonard electric shovels are being used to handle the toughest digging and loading assignments. Those who use them know that Bucyrus-Eries, with their fast operating cycles and durable construction, provide the dependable high-output and low-cost performance that means profitable operation.

61L55

GLOBAL APPROVAL
UNITED STATES · VENEZUELA · ALGERIA · CANADA · CONGO · ENGLAND · FINLAND · FRANCE · INDO-CHINA · MOROCCO · PHILIPPINES · RHODESIA
110-B 4½-cu. yd.
150-B . . 6-cu. yd.
190-B . . 8-cu. yd.
BUCYRUS ERIE

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

75 Years of Service to Men Who Shape the Earth

The tough ones come to Card

How HOMESTAKE solved two HAULAGE PROBLEMS

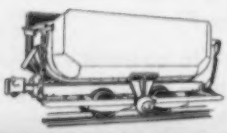
When Homestake Mining Company needed larger haulage capacity, Card engineers were called in. At Homestake, ore cars are automatically dumped while in motion, and haulage ways are limited in cross section. So, special Granby-type cars were chosen to replace the old gable-bottom cars.

Since 1939, 390 of these special Card cars have gone to Homestake on eight successive orders. Designed for maximum capacity, they have only a very minimum of side clearance. They are fabricated wholly of Cor-Ten plate and hold 60 cu. ft. Greatest design change over the years has been to a heavier liner plate to allow loading without the degree of ore fragmentation originally planned. Originally the cars were loaded through 14" grizzlies. Now they are loaded with the largest sizes that will clear the chutes.

Card has recently furnished 61 special Rocker Dump cars for development work at Homestake. These are well suited to handling waste and dumping in old stopes.

WHERE MINING CALLS

for efficient haulage, Card cars are the tested answer. Join Card's many customers. Their repeat orders are added proof of quality for you. Card engineers are at your service . . . no obligation.



C.S. Card Iron Works Co.

2501 WEST 16th AVE., DENVER, COLORADO

Arizona *(Continued)*

attributed to the rise of copper prices from 30 to 40c per pound. Heavy production—despite a 47-day strike—also was a principal factor.

New production from the Lavender pit, Bisbee; Silver Bell, northwest of Tucson, and Pima, southwest of Tucson, mines accounted for about 34,000 tons of the increase.

Outlook for 1956 is even greater because the mine at San Manuel was to be placed in operation in January.

Arizona's summary of production and value includes:

Copper, 455,000 tons, $342,524; zinc, 22,500 tons, $5,535,000; lead, 9,700 tons, $2,929,400; gold, 129,500 oz, $4,532,500; silver, 4,652,000 oz, $4,210,060.

San Manuel Copper Corp. will be in full production by the middle of 1956, according to Wesley Goss, company president.

Production of ore was expected to start in January, said Goss, who also is president of Magma Copper Co. By midyear, San Manuel is expected to be getting out 35,000 tpd ore. Firm will have 1,800 employees by that time and a payroll of $11-million. To date $19-million has been spent in developing and exploring the orebody.

1955 property tax on Ray Mines Division of Kennecott Copper Corp., reflects a 39% increase over the 1954 bill with a total payment of $673,674 to Pima and Gila Counties.

The $593,988 tax in Pinal is 19% of all state and county taxes. Payments bring to $13.9-million the total of all county and state taxes for the Ray Division since the mine was opened.

Gila County tax receipts from major mining in 1955 totaled almost $570,000. Inspiration Consolidated Copper paid $308,274; Inspiration Smelter, $6,771; Riviera Mines, $3,799; Miami Copper Co. and subsidiaries, $211,079; and Kennecott, $39,843.

CALIFORNIA

U. S. Bureau of Mines has announced that the total estimated production of metallic minerals in the state during 1955 was above 1954 production. The total 1955 value was $51,032,100 while the 1954 value was $41,666,283.

Included in the 1955 total are chromite, 22,500 short tons at $1.8-million; copper, 510 at $377,400; gold, 250,500 at $8,767,500; lead, 7,600 at $2,264,800; manganese ore and concentrates, 4,000 at $290,000; mercury, 9,500 at $3,755,500; silver, 910,700 at $824,200; tungsten concentrates, 3,600 at $15.5-million; zinc, 6,700 at $1,648,200; and other metals valued at $16,354,500.

Verdi Development Co. is negotiating with the AEC to get a contract to buy ore from other producers within a 300- to 400-mile radius of the Verdi mill at Mojave, Kern County. AEC presently is listing possible producers in area, with

New OCC Heavy-Media Vessel

THE 'LAST WORD' IN

SIMPLICITY

A Wholly New Approach to HMS

From top to bottom, the OCC Vessel is specifically designed to take advantage of the simplicity of the HMS process. The result is optimum metallurgical performance and trouble-free operation.

The previously common practice of adapting conventional types of equipment to Heavy-Media vessels necessarily resulted in cumbersome and complicated units. The outstanding advantage of the HMS process is its simplicity. Here are illustrations of how the revolutionary design of the OCC vessel capitalizes on this simplicity. A single rake performs both of the two basic HM separatory functions: maintenance of constant gravity in the medium; removal of sink. This rake is the only moving part in the vessel. There are no rotating parts in the medium; and no gears in its drive. The only friction is that between the rubber-tipped rake and the vessel bottom. For details . . .

Send for Information on Complete Pilot Plant Demonstration and Testing Services . . . Technical Bulletin

The ORE & CHEMICAL CORP.

Division: Mining & Milling Machinery

80 BROAD ST., NEW YORK 4, N.Y.

California *(Continued)*

indications that approval may be given such a contract before the end of 1956. Verdi's 75-ton mill went into operation in November processing primary uranium ores from 2,200 acres of land which Verdi leases near Rosamond, 7 miles south of the mill.

Kaiser Steel Corp. has purchased eight placer mining claims at Cushenbury Grade on Highway 18 between Lucerne Valley and Big Bear Lake, San Bernardino County, for more than $1.5-million, according to a grant deed filed with County Recorder Ted R. Carpenter. Claims are in a high grade limerock area. Approximately 1,160 acres were involved in purchase. Present plans call for mining on a contract basis for Kaiser by the projected Permanente cement plant to be erected along Cushenbury Grade, according to a company spokesman.

Great Lakes Oil & Chemical Co. in December made its second shipment of uranium ore, a carload shipment of 46 tons from the Kergon mine in Kern Canyon, 35 miles northeast of Bakersfield, Kern County. Ore was shipped from a railhead in Bakersfield to Vitro Corp.'s mill, Salt Lake City. Ore was stockpiled during a six-weeks period of deep level work in Kergon mine.

Coso Uranium, Inc., of Long Beach in mid-December made the largest shipments of uranium ore yet reported from California. Company shipped four carloads, totaling 200 tons, from Olancha to the Vitro Corp. mill at Salt Lake City. Company has a 500-ton contract with AEC.

According to a company spokesman, Coso ores are middle grade, running from 0.40 to 1.47 in the assays at from $63 to $164 per ton. Coso properties consist of 26 unpatented claims, totaling 520 acres, located east of Haiwee Reservoir on west flank of Coso Mountain Range, Inyo County.

Open pit mining began at Pacific Coast Borax Co.'s mine at Boron Jan. 5, according to J. M. Gerstley, president of the Borax Consolidated Ltd. division. (See *E&MJ*, December 1955, p 73.)

Gerstley

Beginning of mining, following removal of overburden, is the major step in Pacific Coast's $18-million development program. Deposit is the world's only known sodium borate deposit; has been mined by underground methods for some 30 years. Construction of a new refining and concentrating plant should be completed next year, says Gerstley, who also pointed out that improved methods of ore recovery will extend the life of the mine.

New plant and refinery will handle economically all grades and varieties of ore, producing borate concentrates for export and the principal forms of refined borax for domestic use and foreign markets.

COLORADO

Stephen L. R. McNichols, Lieutenant Governor of Colorado and general counsel for Uranium Ore Producers Assn., termed "completely unrealistic" the new competitive bid system for AEC leases, announced by the AEC in December.

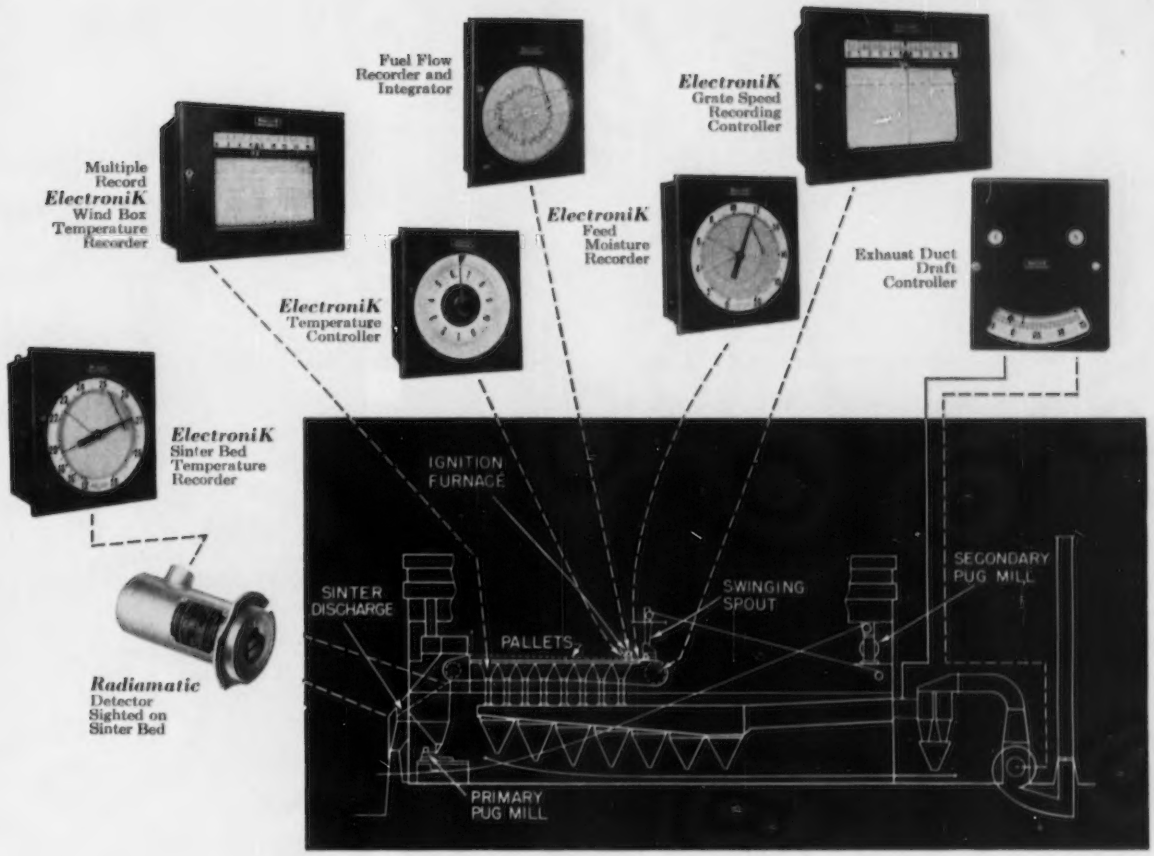
McNichols declared the new program "definitely eliminates all small bidders and is designed to favor a half-dozen large corporations presently engaged in the uranium industry."

The new lease policy, it was said, affects about 525 acres of AEC held land known to contain ore. Most important deposit involved is the multi-million dollar Joe Dandy orebody in the Paradox area of Colorado.

AEC said that despite the new bidding system, some leases will be negotiated. Negotiation might be employed, it was explained, on deposits that could be most economically worked from an adjoining privately-owned mine, or for extension of existing leases.

The AEC statement said "it is unlikely that more than a few deposits will be offered for lease in the near future" and that the uranium deposits under AEC

GET GREATER
CORE
RECOVERY
with cores you know what's below your rig—there's no guess work about formation depth, thickness or age because you are holding a sample of the earth's crust in your hand.
WITH CHRISTENSEN DIAMOND CORING EQUIPMENT
You get a bit engineered for the formation it is intended to core—a barrel designed to receive and keep that core without loss from washing, blocking or friction. You get core recovery even in the most friable formations, yet you more effectively cut the hardest rock—at "LESS COST PER FOOT."
CHRISTENSEN DIAMOND PRODUCTS
1937 SOUTH 2nd WEST • SALT LAKE CITY, UTAH



Complete instrumentation for sintering processes—*available from Honeywell*

THE COMPLEX sintering machines used in modern ore benefication processes demand accurate, automatic control of ore critical variables in order to function at peak efficiency. For the varied requirements of such equipment, Honeywell produces a comprehensive line of instrumentation.

A typical measurement and control system for a sintering machine is shown in the diagram above. From feed of prepared materials to discharge of sinter, this instrumentation covers every phase of process operation.

Ignition Furnace Fuel Control . . . *ElectroniK* Temperature Controller, with appropriate system for regulating either gas or liquid fuels . . . plus Brown Flow Meter for recording and integrating fuel flow.

Grate Speed . . . an *ElectroniK* instrument, working with an electric tachometer element, measures and controls speed by regulating the grate motor or variable speed coupling.

Wind Box Temperatures . . . a multi-point *ElectroniK* instrument records individual temperatures . . . or individual temperature indications, correlated with wind box suction.

Moisture Content and Temperature of Feed . . . can be recorded or controlled by specially calibrated *ElectroniK* instruments.

Sinter Bed Temperatures . . . *Radiamatic* element sighted on bed surface leaving ignition furnace is connected to an *ElectroniK* temperature recorder showing carbon and moisture fluctuation.

Draft Control . . . a Brown Pressure Controller or Flow Controller regulates the exhaust fan to maintain constant draft or air volume.

Your local Honeywell sales engineer will be glad to discuss instrumentation for your specific benefication process. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

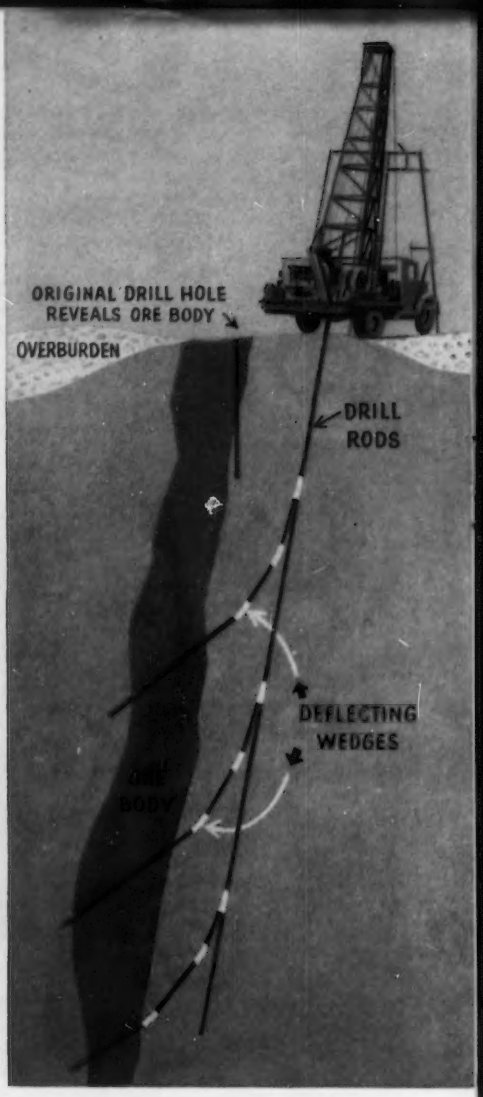
● **REFERENCE DATA: Write for Composite Catalog No. 5002 for a condensed listing of all Brown instruments.**

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

Drill rods of Pittsburgh Steel are used with mobile drill rigs such as this Longyear jeep-mounted model in the world-wide quest for vital minerals.



Directional drilling tests skill of drill crew, strength of drill rods.

Hitting The Bullseye A Mile Underground

Pittsburgh Steel drill rods used by E. J. Longyear Company since 1890's to score impressive prospecting firsts.

Modern prospectors for vital raw materials are scientists. That's why geologists and engineers do the exploratory drilling for E. J. Longyear, the nation's number one prospecting organization.

Since the 1890's when E. J. Longyear himself drilled the first diamond bit into the rich iron ores of the Mesabi Range in Minnesota, Longyear prospectors have used Pittsburgh drill rods. They have accumulated an impressive list of firsts. Here are a few of them:

• **Nickel**—Discovery and development of the millions-of-ton reserves of the Falconbridge Mine near Sudbury, Canada, in 1916.

• **Copper**—First diamond drill exploration of the multi-million-ton reserves of the Roan Antelope and Mufulira Mines, Africa, in 1929.

• **Iron Ore**—First exploration of the half-billion-ton reserves in the Cerro Bolivar, Venezuela, in 1947.

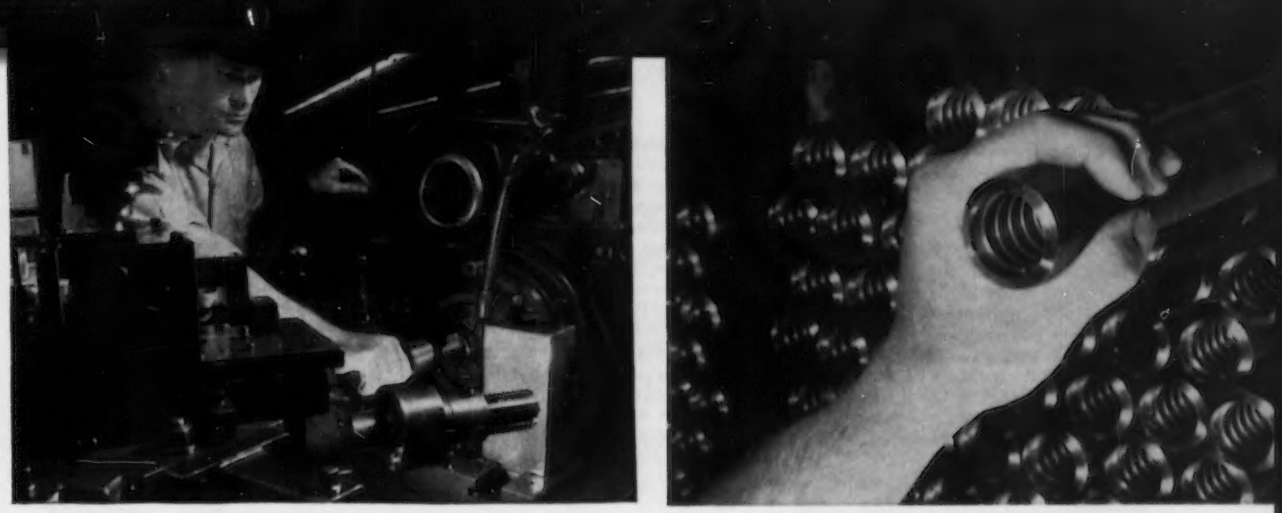
• **Uranium**—First exploration of one of the world's largest (several million tons) uranium bodies at the Jackpile Mine, New Mexico, in 1955.

Here's how Longyear goes about finding strategic minerals:

After geological surveys, the earth's surface strata is pierced with steel drill rods equipped with diamond drill bits. Stabbing into the earth to depths of more than a mile, the drillers strike a target area that often is extremely small. As the drill bit advances it carves out cylindrical cores of the earth's structure. These cores are lifted out for study.

Drillers are under constant competitive pressure to reduce the cost per foot of hole drilled. Their success in keeping costs low determines the profit or loss on an operation, so drill rods are an important factor.

The usual "deep" drill hole will go between 3,000 and 5,000 feet



Finished drill rods (right) provide a tight joint for internal couplings after they are threaded (left).

although some run 6,000 feet and more. Drill rods are used in lengths varying from 2 to 20 feet depending upon the type and size of the drill rig and the depth of the hole.

At 6,000 feet the weight of "NW" size drill rods suspended from the drilling platform is about 17 tons. This is being rotated by a 50 to 75 horsepower engine at speeds up to 800 rpm.

For speed and low costs in drilling, then, the drill rod must come from steel with the physical strength to withstand tremendous torque loading, shock, abrasive wear and fatigue.

If the rod breaks under the abrasion, torque, or the fatigue wear it receives, an expensive "fishing" job is required to recover the drill rods and save the drill hole.

If the rod is not straight and concentric, it develops a "whip" and causes premature drill rod failure and excessive wear.

In directional drilling, the drill rods are subject to all normal physical requirements multiplied many times because the rods are forced around bends while being rotated.

In addition to these requirements, the steel for drill rods must have good machinability that will permit high speed precision machining at low cost.

Longyear uses Pittsburgh Steel's cold drawn seamless mechanical tubing in the .30-.40 carbon range, with an internal upset at both ends, normalized to remove residual stresses and assure complete dimensional uniformity. It provides a tensile strength of 65,000 psi and hardness of between 28 and 32 on the Rockwell C scale.

This tubing arrives at Longyear's plants in lengths that will make 5, 10 or 20-foot drill rods. The outside diameter for these rods ranges from $1\frac{5}{8}$ to $2\frac{3}{8}$ inches. They have a wall thickness of $\frac{3}{16}$ of an inch.

The internal upset enables them to be machined to provide a snug seat for the internal coupling that holds the rods together in a string, without weakening the wall. The upset on a $2\frac{3}{8}$-inch outside diameter tube is to a $1\frac{5}{8}$-inch inside diameter for a distance of 3 inches on each end. A slight defect in the quality of the steel can cause costly tool wear or broken tools.

Pittsburgh Steel meets all of these requirements consistently. Longyear can count on drill rods made from it for economy and reliable performance in the field. That's why you'll find it on almost every Longyear drilling operation.

If you have an application for seamless tubing, why not explore the advantages of reducing your costs and improving your products with Pittsburgh Steel tubes, carefully made to your specifications. A call to our closest district office today will bring prompt personal attention.

Pittsburgh Seamless Mechanical Tubing is also available from:

Baker Steel & Tube Company
Los Angeles, California

Chicago Tube & Iron Company
Chicago, Illinois

The Cleveland Tool & Supply C
Cleveland, Ohio

Drummond McCall & Co., Limited
Montreal, Quebec, Canada

Edgcomb Steel Company
Philadelphia, Pennsylvania

Gilmore Steel & Supply Co.
San Francisco, California

Earle M. Jorgensen Co.

Mapes & Sprowl Steel Co.
Union, New Jersey

Metal Goods Corporation
St. Louis, Missouri

Miller Steel Company, Inc.
Hillside, New Jersey

A. B. Murray Co., Inc.
Elizabeth, New Jersey

C. A. Russell, Inc.
Houston, Texas

Ryerson, Joseph T. & Son, Inc.
Chicago, Illinois

Solar Steel Corporation
Cleveland, Ohio

Steel Sales Corporation
Chicago, Illinois

Tubular Sales
Detroit, Michigan

Ward Steel Co.
Boston, Massachusetts

Ward Steel Service Company
Dayton, Ohio

Pittsburgh Steel Company

Grant Building • Pittsburgh 30, Pa.

DISTRICT SALES OFFICES: Atlanta • Chicago • Cleveland • Columbus • Dallas • Dayton • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh San Francisco • Tulsa • Warren, Ohio. **PLANTS:** Monessen, Pa. • Allenport, Pa. Akron • Los Angeles • Warren, Ohio • Worcester, Mass.

Colorado *(Continued)*

control will be considered a reserve to be drawn upon as required.

U. S. Atomic Energy Commission and Continental Uranium, Inc., of Grand Junction, have signed a contract for construction and operation by Continental of a uranium processing mill at La Sal, Utah, it was announced at the Grand Junction Operations Office of the Commission. Construction of the plant is expected to begin promptly, with completion scheduled for the summer of 1956.

Gunnison Uranium Corp. has been organized in Oklahoma City to carry on uranium operations in Saguache and Gunnison Counties. W. E. Wark Jr. president of Wark and Co., construction contractors of Philadelphia and New York City was elected president. New corporation will engage in uranium, vanadium and thorium mining, and also oil development.

F. R. Henson Jr., treasurer of the company and geologist, announced that the corporation has purchased a one-fourth interest in 144 claims in the Saguache and Gunnison areas of Colorado from Gulf Coast Western Oil Co. also of Oklahoma City. Company is now coring on the claims. Five thousand feet of coring was contracted for with Joy Drilling Co.

Montezuma's first silver mill to be built in half a century started crushing ore at the portal of new Burke-Martin mine, 10,500 ft above sea level, near the western foot of Loveland Pass. Lead-zinc ore "shot full of silver" and a trace of gold is what the new $45,000 mill is built to handle at 50 tpd ore to start. Ore averages $68.80 a ton, say the operators.

Lucky Mc Uranium Corp. monthly shipment allotment of uranium ore has been raised from about 1,500 to 3,000 tons by AEC at Grand Junction. Lucky Mc is trucking its ore to Riverton, Wyo. AEC buying station.

Several truckloads of autunite and torbernite have been shipped out of Jimtown in recent weeks. Mountain States Oil and Uranium Co. shipped several "pilot loads" of autunite by truck to Edgemont, So. Dakota, where the Government has an ore station. Jimtown Uranium Co. has recently shipped the first carload of uranium ore (torbernite) from the Jamestown area. Firm is now digging out its second carload, which is said to be superior to earlier shipment.

Front Range Mines, operating the Strong Mine and the Ajax Mines at Cripple Creek, continues to make shipments of high grade ore with regularity. Last ten shipments of 40 to 60 tons each, averaged above 3 oz of gold per ton—or better than $105 per ton.

Utaco Uranium, Inc., Moab, Utah, announced the purchase of the lead-zinc property, known as the Bradley mine, near Telluride. Bill Hines, Utaco secretary-treasurer said Bradley orebody may total as much as 300,000 tons, with 50,000 tons definitely proven. An independent engineer's report places the average value of the Bradley ore at $30 per ton at present prices, and Hines said one recent carload shipment to a Salt Lake smelter brought $48 per ton.

Engineer's estimate was based on assays averaging 5.97% lead and 4.25% zinc, in addition to gold, silver and copper values. Mining and milling costs were estimated at between $10 and $15 per ton. Hines said Utaco plans to build its own mill at the site, to be completed by spring.

CONNELLSVILLE
Custom Built Mining Equipment
to meet your requirements

BOTTOM DISCHARGE SKIPS - STORAGE BINS - MEASURING HOPPERS - COMPLETE BOTTOM LOADING EQUIPMENT - ROTARY MINE CAR DUMPS - MAN & MATERIAL CAGES - COUNTER-WEIGHTS - SHEAVE WHEELS & BEARINGS -
ELEVATOR TYPE MAN CAGES Including Hoist - Guides - Head Frame - Pent House - Electrical Equipment - wired and installed complete for operation.
REBUILDING CLEANING PLANT EQUIPMENT

Your inquiries are welcome and without obligation

CONNELLSVILLE
MANUFACTURING & MINE SUPPLY CO.
CONNELLSVILLE, PENNSYLVANIA

"Serving the Mining Industry Since 1901"

IDAHO

Highland-Surprise Consolidated Mining Co. and Sunshine Mining Co. are opening the second major vein structure in the new lower tunnel at their joint-venture on the Deer Trail property in Custer County near Stanley. A drift has been run about 100 ft along the footwall of a wide mineralized zone, exposing 2 to 7 ft of good ore, with lower grade mineralization extending for an undetermined distance into the hanging wall. Fourteen samples from the first 70 ft of drift averaged 5½% lead and 9½% zinc.

High-grade section of the big zinc vein intersected by the lower adit several months ago has been exposed for a

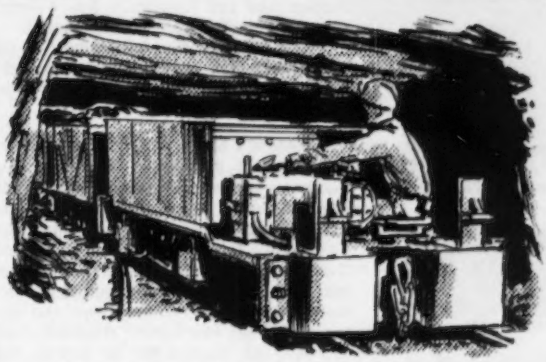
FACTS ABOUT Exide®

IRONCLAD® MINING BATTERIES

NEW WAY TO CUT COSTS, BOOST PRODUCTION...

TWO-WAY MINE TRACTOR SERVICE ...DEPENDS ON EXIDE-IRONCLAD POWER!

LOOKING FOR A WAY TO CUT PORTAL-TO-PORTAL TRAVEL TIME 50%...TO MOVE SUPPLIES AND EQUIPMENT WITHOUT HALTING THE NORMAL FLOW OF PRODUCTION? EXIDE-POWERED RUBBER-TIRED TRACTORS AND TRAILERS, LIKE THE KERSEY TRACTOR SHOWN, DO SERVICE JOBS FASTER...SAFER...AT LOWER COST. USE TRACTORS-POWERED WITH LONG-LIFE EXIDES FOR FAST, LOW-COST HAULAGE!



MORE TRIPS PER SHIFT! WITH DEPENDABLE EXIDE-IRONCLADS...

CAR CHANGES ARE SPEEDED, LOADERS KEPT BUSY, AND HAULAGE MOVES FAST WHEN LOCOMOTIVES ARE POWERED WITH EXIDE-IRONCLADS. EQUIPMENT WORKS FULL-SHIFT, DOWN-TIME IS ELIMINATED. YOU GET MORE PRODUCTION PER MAN-HOUR WITH LESS COST PER TON HANDLED. DEPENDABILITY AND LONG USEFUL LIFE MAKE EXIDE-IRONCLADS YOUR BEST POWER BUY- *AT ANY PRICE!*

WORKED TO DEATH TO LEARN SECRET OF LONGER LIFE...

LAB TESTS OF IRONCLADS AGAINST CONVENTIONAL BATTERIES SHOW THAT THEY PERFORM BETTER...HAVE FROM 20% TO 30% LONGER LIFE! THESE FACTS, DEMONSTRATED BY THOUSANDS OF BATTERY USERS, EXPLAIN WHY EXIDE-IRONCLADS ARE YOUR BEST MINING BATTERY BUY- *AT ANY PRICE!* SINCE 1910, RESEARCHERS HAVE GREATLY IMPROVED EXIDE-IRONCLAD PERFORMANCE AND USEFUL WORKING LIFE, BUT THE BASIC IRONCLAD PRINCIPLE OF TUBULAR CONSTRUCTION REMAINS THE SAME.

LET EXIDE HELP SOLVE YOUR MINING BATTERY PROBLEMS. ❶ CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS. ❷ WRITE FOR FORM 1982, A MANUAL ON MAINTAINING MOTIVE POWER BATTERIES.

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

Idaho *(Continued)*

strike-length of 45 ft and drilling is underway to determine the full width of mineralization.

Whitedelf Mining & Development Co. has resumed development work at its property near Clark Fork in Bonner County after a three-month shutdown necessitated by the shortage of good miners. Approximately 700 ft of exploration work on the new 800 level remains to be done under a DMEA contract.

A crew of 7 men is now employed on a one-shift basis. Principal objectives are the opening of the downward extension of the South orebody and further exploration of the North orebody.

Lucky Friday Silver-Lead Mines Co. completed preparation of station facilities for its new 2300-ft, three-compartment shaft early in December and began installing a 400-hp hoist with expectations that it would be ready for operation early in 1956.

Day Mines, Inc., is planning to sink a vertical winze from the 1600 to the 1900 level in the westerly part of its old Hercules Mine in the Coeur d'Alene District north of Burke to carry on deeper exploration of the new "Rambler" vein. On the 1600 level, mineable ore of good width and grade has been exposed for a distance of about 500 ft.

Bunker Hill & Sullivan Mining & Concentrating Co. will start a major expansion project at its electrolytic zinc plant at Kellogg as soon as weather conditions permit commencement of construction. Ultimate goal of the project is a 50% expansion of present facility, increasing capacity from 4,800 to 7,200 tons of special high-grade slab zinc annually. Initial objective, to be completed in about a year and a half, is 1,200 tons additional capacity at an estimated cost of $7-million.

Polaris Mining Co. has resumed development work in the Chester Mining Co. area of the Chester vein system from the 3,000 level of its adjoining Silver Summit Mine. A drift is now being run on the vein to open the zone where drills intercepted good ore several months ago and a crosscut is being run southerly from the exploration lateral to gain position for downhole drilling to test the ore zone at an additional 200 ft of depth.

Salmon River Scheelite Corp.'s new lower tunnel has opened what appears to be a substantial tungsten orebody at a depth of 200 ft on its property northwest of Clayton in the Bayhorse District of Custer County. Vein is 40 ft wide at the lower horizon, with two high-grade zones 3½ and 2 ft wide, respectively, which assay 2.94% tungsten trioxide. Drifts on the wider high-grade zone have been advanced for a distance of about 30 ft both north and south from the crosscut intersection and the high-grade has widened to 5 ft in both faces, officials report.

Present plans are to complete the $39,040 DMEA project under which the lower tunnel was driven to block out the orebody.

Rare Metals Corp. of America, mining subsidiary of El Paso Natural Gas Co., has brought back into production the old Idaho-Almaden mercury mine in Washington County which has lain idle since 1942. Since taking a lease and option on the property in the fall of 1954, Rare Metals has developed substantial ore reserves in three known orebodies and discovered one new one, removed vast tonnages of overburden to expose the ore for open-pit mining, and set up a processing plant housing the world's largest rotary kiln for furnacing mercury ores. The new operation has been producing at plant capacity of 175 tpd ore since mid-September.

MINNESOTA

With 1956 program scheduling some 90-million tons of iron ore output, mines in the area are working to complete one of the biggest winter stripping campaigns in many a year. Normally the winter months mean slack times to the miners, but this year there will be plenty of winter work.

Shipments of iron ore on Great Lakes for 1955 set a peacetime record of 87,459,-

Interior of a Hardinge 11½′ x 12′ Rod Mill with 85-ton rod load, 1000 horsepower.

Hardinge
ROD MILLS

Sizes range from 2′ to 11½′ shell diameter and up to 1000 horsepower.

Types include trunnion overflow and peripheral discharge for both wet and dry grinding.

Applications include both open and closed circuit arrangements for ores, aggregates, concrete sand, cokes, and abrasives.

Complete specifications on request. Bulletin 25-C-1.

Trunnion overflow mill

End peripheral discharge mill

Center peripheral discharge mill

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

TOPS IN TEAM WORK—ALL THREE

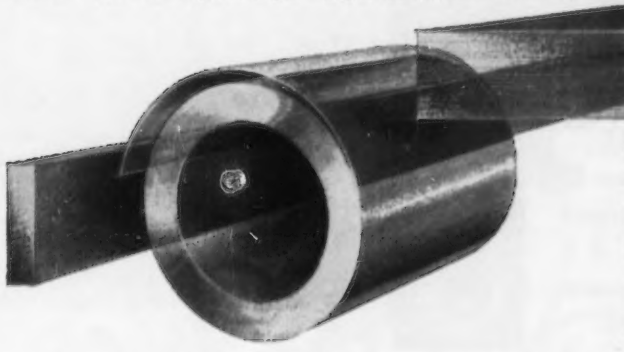
each does a special job

J&L's JALTEN series offers you three top performing high strength, low alloy steels with the following characteristics:

JALTEN NO. 1—High strength, good formability and fabricating—good resistance to low temperature impact.

JALTEN NO. 2—High strength, moderate forming—improved resistance to atmospheric corrosion.

JALTEN NO. 3—High strength—improved abrasion resistance.



SEND FOR THIS NEW BOOK:
Chemical properties of Jalten
Mechanical properties of Jalten
Jalten equivalents
Jalten application data

Jones & Laughlin Steel Corporation
Dept. 412—3 Gateway Center
Pittsburgh 30, Pennsylvania

Please send a copy of your Jalten booklet, *JALTEN LOW-ALLOY, HIGH-STRENGTH STEEL.*

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

J&L STEEL

Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*

Minnesota *(Continued)*

853 tons, with those for December being 184,390 against 17,644 tons in December 1954. Total shipments for 1954 were 60,793,697 tons. 1953 total was 95,844,449 tons. Almost 59% of 1955 shipments were handled at Duluth harbor on Lake Superior.

Pickands, Mather & Co. will carry on a more extensive stripping program this winter than was conducted in 1954-1955. Tioga No. 2 (a new mine), West Hill, Bennett, Scranton and Embarrass mines will all be busy. Scranton will repair tailings pond dam which broke away last fall. Pickands, Mather & Co.'s Cuyuna Range mines will also be active and Zenith underground mine on Vermilion Range will stockpile high-grade ore for next season.

Oliver Iron Mining Division closed its 1955 season with a sizable shipment of 36,200,000 tons of ore sent to U. S. Steel Corp. mills: 9½-million tons ahead of last year, reports R. T. Elstad, president. These shipments included 6-million tons of iron ore concentrates of which about 600,000 tons was taconite nodules and sinter.

Large proportion of the concentrates came from Oliver's Canisteo district where a new unit was added to Arcturus plant in 1955. District also has the large Oliver Trout Lake plant, and the range's first iron-ore washing plant.

Oliver's eastern district shipped 15½-million tons. District includes Mesabi Range from Mountain Iron eastward and underground mines on the Vermilion Range. Hibbing-Chisholm district produced 15-million tons for the season.

Jones & Laughlin Steel Corp. has been conducting an extensive diamond drilling program in three separate areas. One is near Kirkland Lake in eastern part of Ontario Province; second is near Bending Lake in southwestern Ontario and third is on Vermilion Range of Minnesota, near Ely, and includes Section 30 mine.

Last shipment of ore from Section 30 was in 1923 and total shipments from the mine between 1910 and 1923 were 1,457,295 tons. Section 30 Mining Co. was the operator.

Mary Ellen mine of Pioneer Mining Co. shipped 452,152 tons in 1955, about 9,000 tons less than 1954.

Steep Rock Iron Mines, Ltd., had its best season in 1955 with shipments of more than 2¼-million tons, about 1-million tons above its previous record of 1,326,724 tons in 1951. 1956 season, as presently scheduled, calls for another increase of about 1-million tons to 3¼-million tons. This large tonnage will come 70% from Hogarth open pit and 30% from Errington underground mine.

Jones & Laughlin Steel Corp. has joined the steadily growing list of industrial organizations that are rendering aid to education in some form. Jones & Laughlin's program—at an estimated cost of $115,000 per year—will consist of six fellowships yearly; grants to educational institutions and matching employee contributions to colleges from which they have graduated.

Snyder Mining Co. on conclusion of its shipping schedule at Webb mine in Hibbing and Whiteside mine at Buhl, began stripping at both properties in anticipation of another busy season in 1956.

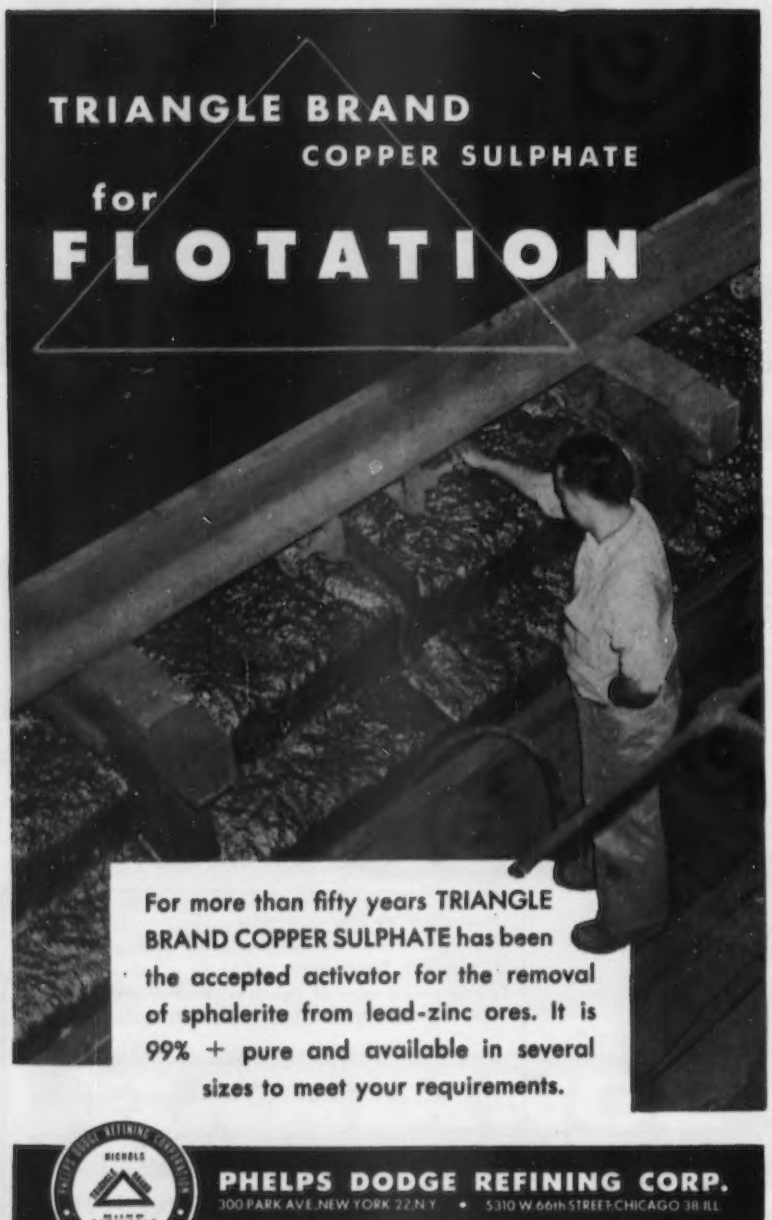
Haley-Young Mining Co. concluded the 1955 season with shipments of 178,813 tons from its Elbern and Minnewas mines on the Mesabi Range as compared to 99,267 tons in 1954.

W. S. Moore Co. shipments for 1955 were 618,561 tons, about 64,500 tons above those for 1954. Shipments came from nine properties on Mesabi Range.

On Nov. 2, 1955, Biwabik mine at Biwabik loaded its last truck of ore. Orebody was discovered in 1891 and the following year Drake & Stratton, railroad contractors, began stripping at the property, using the first steam shovel on Mesabi Range.

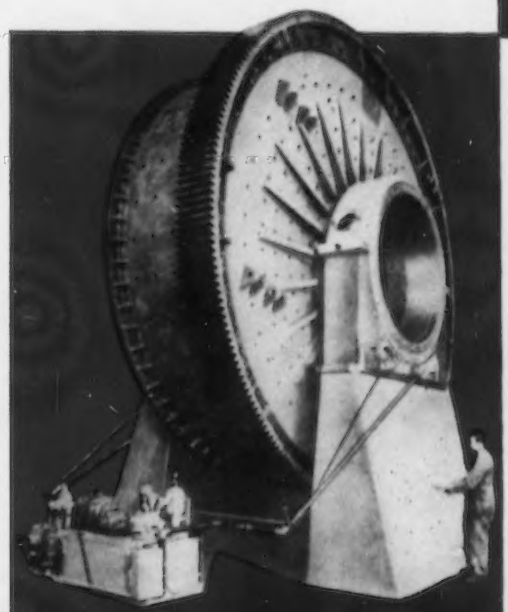
Pickands, Mather & Co., the mine's fourth and last operating company, took over in 1924.

Jones & Laughlin Steel Corp.'s Minnesota Ore Division shipped a total of 3,024,191 tons for the 1955 season including shipments from both the Schley and Pettit mines at Gilbert which were idle in 1954. Last year the company's

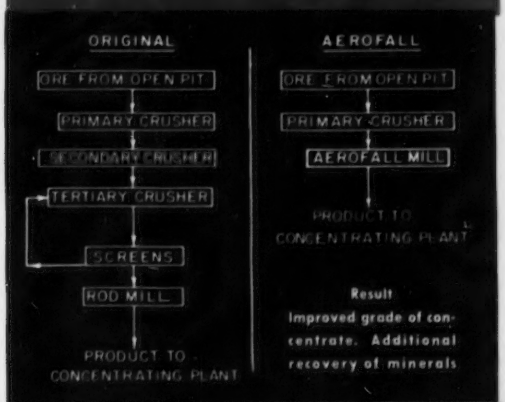

TRIANGLE BRAND
COPPER SULPHATE
for
FLOTATION
For more than fifty years TRIANGLE BRAND COPPER SULPHATE has been the accepted activator for the removal of sphalerite from lead-zinc ores. It is 99% + pure and available in several sizes to meet your requirements.
PHELPS DODGE REFINING CORP.
300 PARK AVE. NEW YORK 22, N.Y. • 5310 W. 66th STREET, CHICAGO 38, ILL.

Cut your
CRUSHING AND GRINDING COSTS
with the.....

AEROFALL MILL



IRON ORE FLOWSHEET COMPARING ORIGINAL PLANT WITH AEROFALL SYSTEM



● Here's a compact, continuous dry crushing and grinding system that is electronically controlled and fully automatic. The AEROFALL MILL combines crushing and grinding in a single operation, thus several stages of crushing which precede conventional grinding equipment are unnecessary . . . . With this circuit you save on initial installation cost, reduce labor costs, lower power costs, reduce steel consumption and cut reagent costs. Increased metallurgical recoveries are indicated on lead-zinc, and copper sulphides and on iron and uranium oxides.

Write for Bulletin 55A
for complete details.

Shown is a plan view of a unique patented arrangement of six 17 foot AEROFALL MILLS grouped around a common ore feed bin at a large Asbestos property in Quebec Province. Designed for a capacity of 5,000 tons per day, this arrangement eliminates complicated and costly feeding apparatus.

AEROFALL MILLS TRADE MARK REG'D.

Aerofall MILLS, INC.
1025 WEST THIRD AVENUE
COLUMBUS 8, OHIO, U.S.A.
AEROFALL MILLS LTD., 129 ADELAIDE STREET, WEST, TORONTO, CANADA
AFRICAN AEROFALL (PTY) LTD., MARITIME HOUSE, JOHANNESBURG, SOUTH AFRICA

Minnesota *(Continued)*

shipments from the seven mines which produced in 1955 were 1,111,138 tons.

MICHIGAN

Pickands, Mather & Co. will have several actively stockpiling mines this winter: Newport, Mauthe, Peterson, Eureka, Sunday Lake and Cary on Gogebic Range and Buck group on the Menominee.

North Range Mining Co. shipped 822,900 tons of ore from its four operating mines in Michigan in 1955: Book mine at Alpha, Menominee Range, shipped 143,038 tons; Champion, Marquette Range, 151,364 tons; Warner, Menominee Range, 158,060 tons and Penokee, Gogebic Range (operated by Republic Steel Corp. in 1954), 370,438 tons. In 1954 these mines shipped a combined tonnage of 638,943 tons.

In addition to its Michigan mines, North Range shipped 193,179 tons from Leonidas underground mine near Eveleth on Mesabi Range which it leased from Oliver Iron Mining Div. in 1953. Total North Range shipments for the season were 1,016,079 tons.

Bradley mine at Iron Mountain shipped 35,989 tons in the 1955 season, more than double the 16,824 tons of 1954 and its largest tonnage since 1948 when it produced 39,696 tons. Mine is operated by E. C. Bradley & Sons.

Eleven Cleveland-Cliffs Iron Co. employees who have worked for the company 40 years without a lost time accident were given an honorary dinner at Ishpeming attended by 150 people. Cleveland-Cliffs officials from Michigan and Minnesota were among the guests and the forty men were presented the Joseph A. Holmes Safety Award.

The 1956 officers of Iron County Engineers' Club are: Warren Jamar, mechanical engineer with M. A. Hanna Co., president; John R. Quayle, supt. of M. A. Hanna Co.'s Hiawatha mine, vice president; Richard Brewer, of the Cleveland-Cliffs Iron Co., re-elected secretary.

Inland Steel Co.'s Morris and Greenwood mines on Marquette Range and Sherwood and Bristol mines on Menominee Range, shipped a total of 1,145,379 tons in 1955. Sherwood, in spite of being idle for more than three months due to a cave-in and flooding at the Spies mine, was Inland's best producer with 402,947 tons.

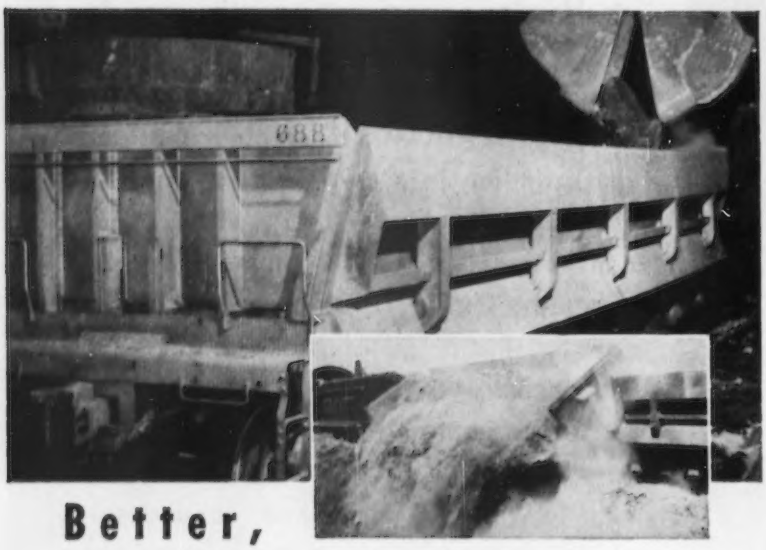
NEVADA

Nevada mines division of Kennecott Copper Corp., and Consolidated Copper Corp., two big operators in White Pine County, have set up an annual scholarship at University of Nevada for a student from White Pine County. Award is made through Coppermines Foundation Inc., and will provide $500 annually through all four years of college for each qualifying recipient.

Gold Metals Co. which is operating a uranium mine at Belmont reports finding good ore at the 150-ft level. Ore is in a fracture which has the same strike as the high-grade stringers found on the surface. Indications are that ore zone will be wider than first expected, and a tunnel is being driven, following the vein of autunite in its footwall. James Gavin and Bob Benjamin, tunnel contractors, have progressed 150 ft in 25 working days. Harry Hughes, Goldfield geologist, is in charge of exploration work.

Argentum Mining Co. which is producing silver ore from Northern Belle mine at Candelaria, has completed its modern mill at nearby Columbus Marsh, and is now employing 44 men. Mill is being set up to handle 500 tpd, and production is being carried on from Northern Belle, which has been opened up to the depth of 1700 ft.

Earlier in this century the same mine produced $15-million worth of ore, and values remain high during present operation. Housing project is being planned at Mina to take care of the Argentum Co. personnel. Officers of the firm are E. S. Gates, president, J. A. Crowther, vice president, and Carl E. Earl, secretary treasurer.



Better, More Economical . . . via DIFFERENTIAL

The yawning bucket drops a huge chunk of waste into this Differential Air Dump Car. Next time the "Sunday Punch" may be tons of reddish hot slag.

For day in, day out service under the rigors of steel mill loading practice, these Differentials perform to the point where steel mills are buying more and more every year.

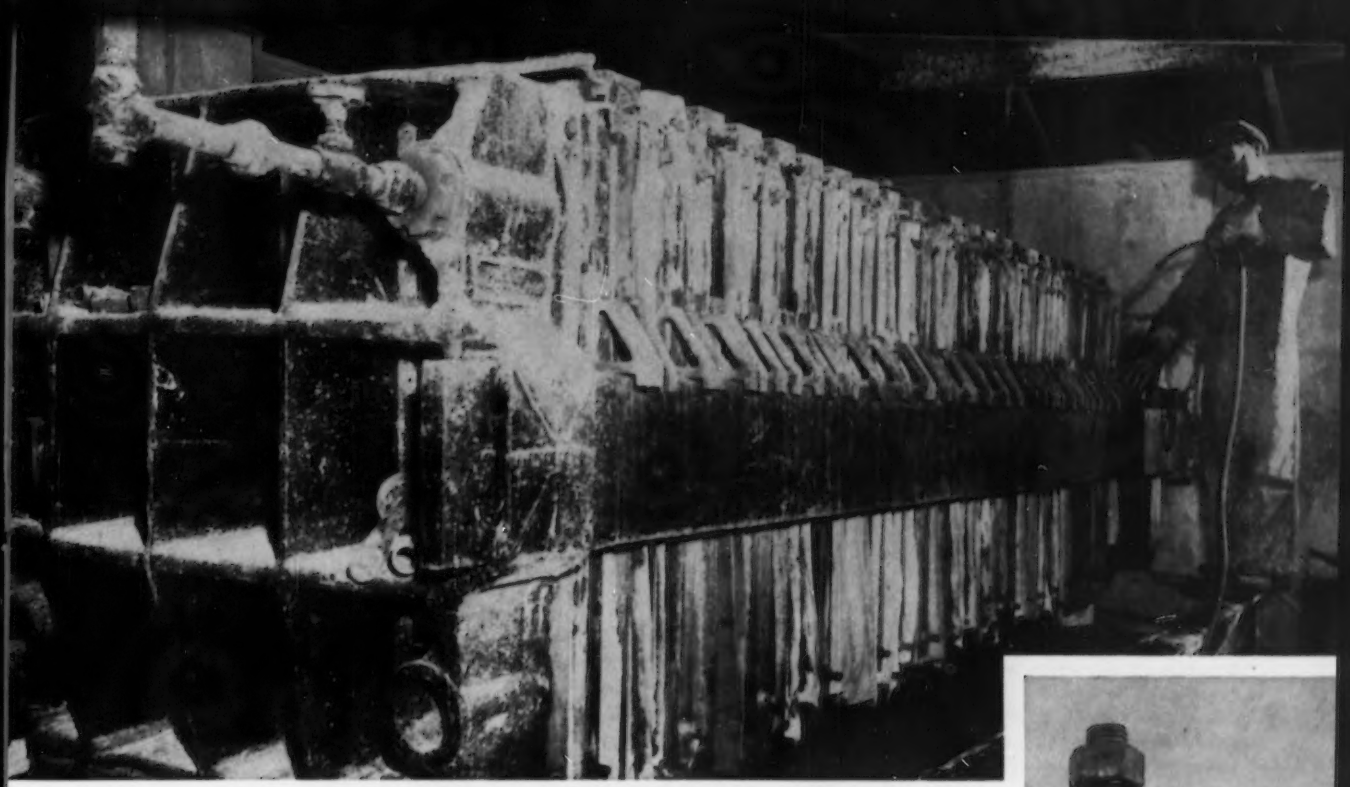
Unusually rugged design and construction, plus heat resistant floors, when indicated, are part of the answer. Out at the dump it's a matter of seconds to unload completely anything that can be loaded — dumping to either side. It all adds up to better, more economical transportation via Differential.

Send for detailed specifications!

DIFFERENTIAL PRODUCTS INCLUDE: Air Dump Cars, Charging Box Cars, Ingot Mold Cars; Locomotives, Mine Cars, Mine Supply Cars, Rock Larries, Mantrip Cars, Dumping Devices and Complete Haulage Systems.

DIFFERENTIAL STEEL CAR COMPANY
FINDLAY, OHIO

SINCE 1915—PIONEERS IN HAULAGE EQUIPMENT



Stainless Steel pays its way *7 times over* in beneficiation of rare earths

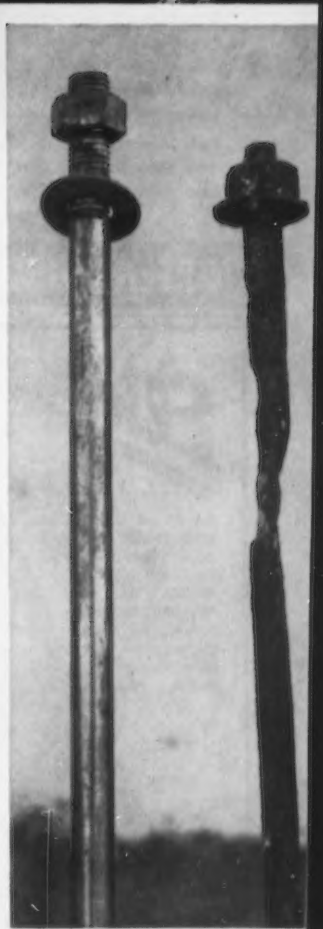
Rare Earths, Inc., of Pompton Plains, N. J., is a major producer of thorium and rare earths, such as cerium, lanthanum, praseodymium and samarium. In the usual form of oxides or salts, these metals have great value in the manufacture of high luminosity carbon electrodes, non-corroding optical glasses and polishing abrasives—to name just a few of the many uses.

Typical plate assembly. Stainless is used for rods and screws in plate hanger.

Most monazite ores (the type processed at Rare Earths, Inc.) are purified by an elaborate chemical separation method. A precipitate is formed and then filtered in a 24-foot-long, 42-inch-square filter press. The wooden plates are held together with long steel rods, which formerly had to be replaced every 6 months because of intense corrosion.

The type 316 Stainless Steel rods, which they began to install as replacements in 1949, are still in perfect condition and have paid for themselves 7 times over. There is much less down time on the filter press and production is up. Although the applications are classified, Stainless Steel is used in many other places at the plant. In the words of Richard Mandle, Plant Manager, "We heartily recommend the use of Stainless Steel for acid and corrosive conditions."

When you buy Stainless Steel equipment, be sure of service-tested quality. Specify USS Stainless Steel.



The new and the old. Carbon steel rod at right had less than 6 months service.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

SHEETS • STRIP • PLATES • BARS • BILLETS • PIPE • TUBES • WIRE • SPECIAL SECTIONS

6-21

UNITED STATES STEEL

get more earning power with...

Greensburg storage battery locomotives

5 TON HIGH TYPE MONITOR

Available in 3 to 12 tons: 42 to 48" high, 18 to 56½" track gauges.

Greensburg's dependable performance results in operating economy. Advanced engineering design and custom-building to specifications give Greensburg Locomotives up to 20% more efficiency and longer battery life than any other storage battery locomotive of equal weight and battery capacity. More earning power per dollar invested!

Built in single or double motor drives with double equalizers, drum or contactor type controllers, with or without dynamic braking, Greensburg Locomotives will haul more and cost less to operate!

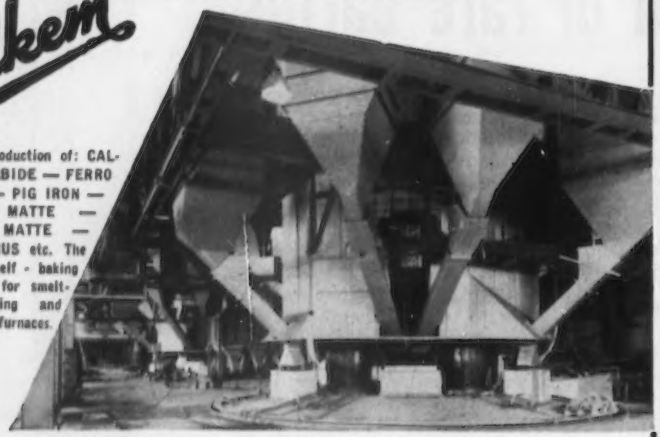
Send us your haulage problem today!

GREENSBURG MACHINE CO. 102 STANTON ST. GREENSBURG, PA.

Electric Smelting Furnaces

Elkem

For the production of: CALCIUM CARBIDE — FERRO ALLOYS — PIG IRON — COPPER MATTE — NICKEL MATTE — PHOSPHORUS etc. The Soderberg self - baking Electrodes for smelting, melting and aluminum furnaces.



Furnace Platform of three 33,000 KVA Elkem Pig Iron Furnaces (Type Tysland—Hole) at Mo i Rana, Norway

In existence for over 50 years, Elektrokemisk has served as consultants and constructors of smelting plants and aluminum reduction cells.

Leaders in metallurgical plant design and erection, Elektrokemisk has introduced Soderberg safe self-baking electrodes and furnace construction in over 30 countries all over the globe.

Consult Elektrokemisk's New York Office regarding your furnace construction problems.

ELEKTROKEMISK A.S.

101 Park Avenue, New York 17, N. Y.

(Head Office: Oslo, Norway)

Nevada *(Continued)*

Wah Chang Mining Corp. which operates Lincoln mine at Tempiute is now producing 825 tpd tungsten ore. Of this amount 700 tpd are being milled on a 24-hours-per-day, seven-days-per-week basis. E. G. Woods is general superintendent of the Lincoln County mining operation, John Russell is assistant superintendent, Larry Davis is mill superintendent, and Al Nielson is mine superintendent.

Consolidated Eureka Mining Co. operating on Prospect Mountain near Eureka, will have an oil-surfaced road built to its property by the Nevada Highway Dept. in the near future. Shipments of ore are being made on a steady basis from mine to a Utah smelter, and are showing high values in gold, silver and lead. A station has been cut at the 400-ft depth and a drift driven 70 ft to the downward projection of the rich orebody discovered a year ago. Roger M. Caywood is superintendent of the property which is controlled by the Hogle interests of Salt Lake City.

NEW MEXICO

Mine Production for the fiscal year end-June 30, 1955 amounted to $110-million. *New Mexico Miner* reported that the output was almost equally divided between metallics and nonmetallics. No fatal mine accidents were reported in that period, although two fatalities occured in mills. Coal output declined from previous years and recent activity indicates that lead and zinc production will increase, along with potash, in the coming year.

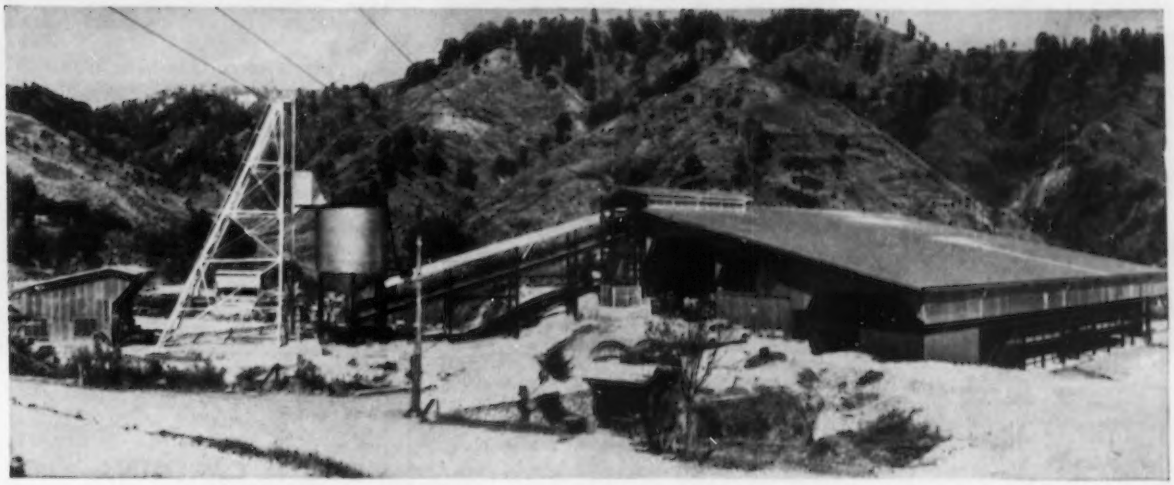
OREGON

Mercury & Chemicals Corp., New York, N. Y., has acquired control of Black Butte cinnabar ore properties in southwestern Oregon, where Quicksilver Syndicate has held the long idle mine for a number of years. Richard P. Fischer, president, San Francisco, confirmed the lease and purchase option agreement in Eugene, Ore., and said the New York firm plans to spend about $250,000 for exploration and production from what he called one of the very large known U. S. deposits of low-grade mercury.

Mine, rated as Oregon's second largest producer since discovery in 1898, was described by Fischer as a profitable operation because of favorable factors regarding mountain slope and ore vein characteristics which permit entrances at "almost any desired level" to reach ore, strong wall rock obviating ore pillars and little timbering and no water pumping. Favorable year-around climate and mine location but 18 miles from Cottage Grove, described as a ready source of high quality labor, were noted by the San Francisco executive.

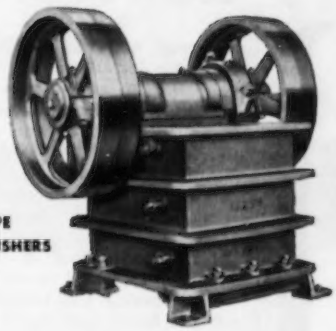
The large orebody averages only 3 lb of mercury per ton, but Fischer said

MINING EQUIPMENT



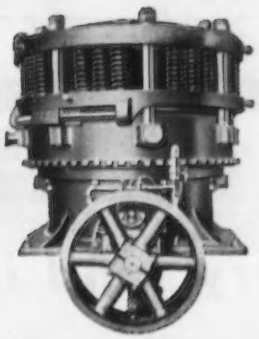
Baguio Gold Mining Company's mill in the Philippine Islands uses all of the Telsmith equipment shown below.

BY TELSMITH



JAW TYPE
PRIMARY CRUSHERS

SEND FOR
DESCRIPTIVE
BULLETIN
266



GYRASPHERE
SECONDARY
CRUSHERS

VIBRATING SCREENS

Min. 39

ORE SUPER-SCRUBBERS

SMITH ENGINEERING WORKS

502 E. CAPITOL DRIVE **MILWAUKEE 1, WISCONSIN**

Representatives in Principal Cities in All Parts of the World • Cable Address: Sengworks, Milwaukee

TACONITE
project drillers know drill bits

. . . and ROK-BITS are their favorites!

Carbide Rok-Bits—cross, "X" or chisel types—gauge sizes: 1¼" thru 6".

One of the largest taconite developments in the Mid-West tested Rok-Bits® against all others. Result: Almost 100% usage of Rok-Bits. If you are using another carbide bit let us show you by COMPETITIVE TEST what Rok-Bits can do to boost your output and profit. Call our nearest plant. Request Bulletin B-1.

Brunner & Lay Products

Brunner & Lay, Inc.
9300 King St.
Franklin Park, Ill.

Brunner & Lay Rock Bit of Philadelphia, Inc.
2514 E. Cumberland St.
Philadelphia 25, Pa.

Brunner & Lay of Los Angeles, Inc.
2425 East 37th St.
Los Angeles 58, Calif.

Brunner & Lay, Inc.
150 Leslie St., Dallas, Texas

Brunner & Lay Rock Bit of Asheville, Inc.
Sweeten Creek Road, Asheville, N.C.

Brunner & Lay of Portland, Inc.
660 N. Tillamook St., Portland 12, Ore.

STEEL

Every kind in stock

Immediate shipment

Principal Products: Bars, Structurals, Plates, Sheets, Tubing . . . Carbon, Alloy and Stainless Steels, Machinery and Tools, etc.

RYERSON

Joseph T. Ryerson & Son, Inc. Plants at: New York • Boston • Wallingford, Conn. • Philadelphia • Charlotte, N.C. • Cincinnati • Cleveland • Detroit • Pittsburgh • Buffalo • Chicago • Milwaukee • St. Louis • Los Angeles • San Francisco • Spokane • Seattle

Oregon *(Continued)*

U. S. Bureau of Mines has blocked out 76,550 tons of this grade and drilling indicates another 200,000 tons potential. One hole penetrated what Fischer called an "unusually high-grade" 2-ft wide vein at 397-ft depth which assayed at 121.2 lb per ton.

Fischer reported his company had employed as consultant Curt N. Schuette, author of a 1938 Oregon Department of Geology & Mineral Industries Bulletin on mercury producing properties. Schuette has recommended a new ore reduction plant be built at the mine site.

Mining machinery has been taken into newly-staked claims of the Juniper Bear Mining Co., Eugene, by Metal Services Inc., Roseburg, in preparation for early mining of uranium ore. Entrance of machinery capped a flurry of staking along Bear Creek, located in central Oregon's Crook County, in what looks like an important ore body.

SOUTH CAROLINA

Output of clay, sand, gravel, stone, vermiculite, mica and cement totalled $17,364,000 during 1954. According to J. R. Thoenen, mineral nonmetallics output for the state was 2% down from 1953.

SOUTH DAKOTA

A group of Dakota miners has laid plans for formation of a four-state organization to promote development of uranium found in lignite beds. Plans call for appointment of one director each from Jamestown, Minot, Dickinson, Wahpeton, Williston, Bismarck-Mandan and Bowman areas of North Dakota, two from South Dakota and one each from Montana and Wyoming.

Idea was hatched at a seminar in Mandan, N. D. Proposed organization was not named. Vast lignite beds underly western North and South Dakota.

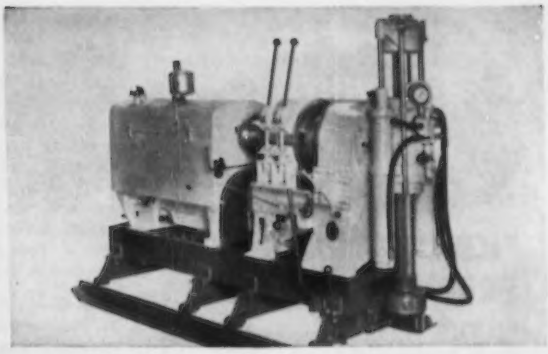
UTAH

Utah Construction Co. is scheduled to initiate its formal discussions with the Atomic Energy Commission during next few weeks on question of erection of a uranium mill serving Gas Hills district, Fremont County, Wyo. The company would build the mill with Lucky Mc Uranium Corp., Salt Lake City. W. H. H. Cranmer, Lucky Mc president, said that UC had been engaged in drilling confirmation tests in ore reserve determination. To date, the UC holes have shown confirmation of the 125,000 ft of exploratory drilling completed by Lucky Mc.

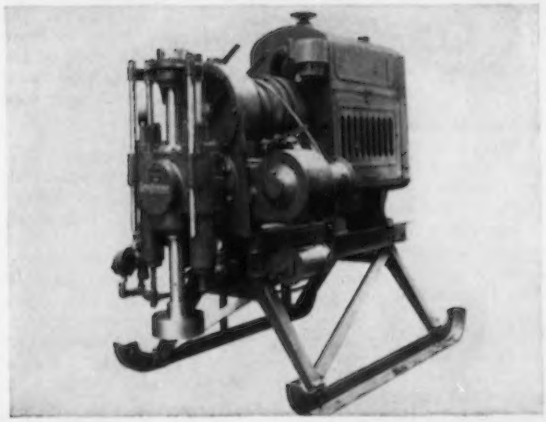
Drilling will continue in efforts of the companies to increase reserve needed in mill negotiations. However, Cranmer said that UC-AEC talks on contract need

Longyear

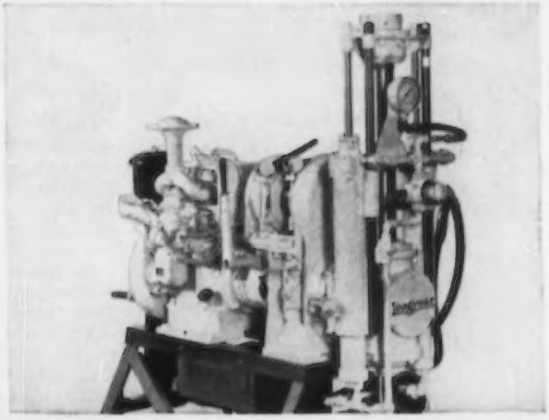
A Longyear core drill for every job



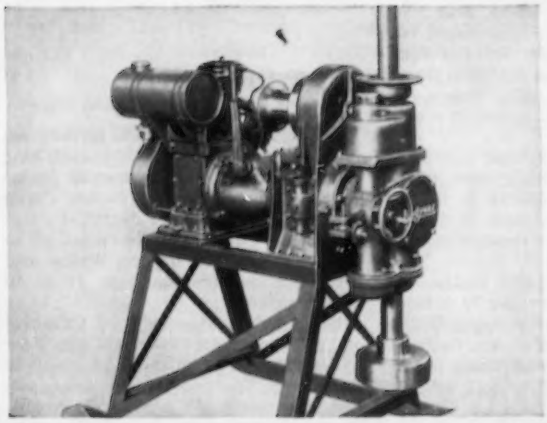
The "44" heavy duty drill
capacity 4000 feet of AW rod



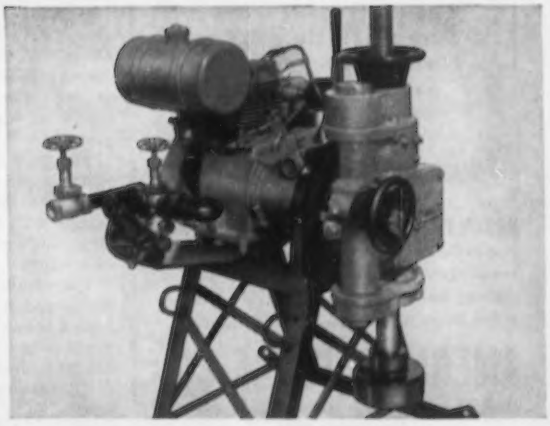
Junior Straitline
capacity 1350 feet of EW rod



The "24" drill
capacity 750 feet of EW rod



The Prospector
capacity 325 feet of EW rod



The Porta
capacity 200 feet of XRT rod

E. J. Longyear Co. MINNEAPOLIS, MINN. · CABLE LONGCO
CANADIAN LONGYEAR LTD., NORTH BAY, ONTARIO · LONGYEAR ET CIE., PARIS, FRANCE

WHY
AFCO

"ICDH" GRINDING BALLS
GRIND 6 to 10% LONGER

"ICDH" means Improved Carbon Deep Hardened—and you'll avoid out-of-roundness, spalling, splitting, fast wear, and excessive downtime by using AFCO "ICDH" grinding balls. These balls have a hardness and toughness comparable with costly alloy balls. Here's why:

They are forged from steel produced to exacting chemical specifications, in our own hearths; consequently, we can test each ingot before rolling.

In addition, the right steel for each ball size is determined by hardenability testing. Automatic upset forging assures proper grain flow and produces the roundness needed for long, uniform wear.

After forging, AFCO grinding media receive carefully controlled heat treatment to produce maximum hardness and penetration consistent with toughness.

RESULT: AFCO "ICDH" balls give you performance comparable with alloy balls – yet they cost no more than ordinary carbon balls. Sizes: ¾" to 5". Phone, write or wire NOW for quotations.

AMERICAN FORGE CO.

Executive offices and plant: Niles, California
Phone Niles 3311

Sales offices: 101 Park Ave., New York City; Portland, Oregon; Los Angeles, Calif.; Salt Lake City, Utah

"AFCO" PRODUCTS

Utah *(Continued)*

not be held up because of a few weeks more of drilling. "We can talk about metallurgy," he said.

It is estimated that on basis of drilling completed to date, Lucky Mc properties have in excess of 1-million tons of ore. Firm is said to be considering running ore with head as low as 0.04% uranium oxide, providing it is able to secure approval from AEC for erection of a really large mill.

Blue Goose Mining, Inc., of Farmington, N. M., reported in December an orebody of approximately 50,000 tons has been blocked out on its Circle Cliffs property in Emery County.

L. E. Murray, Blue Goose president said one ore hole showed 34 ft of mineralization, including one 10-ft segment with over 1% uranium oxide content, according to the probe log.

Blue Goose drilling program was contracted to Copper Canyon Mining Industries, Inc., of Farmington. Corporate control of Blue Goose has been purchased by J. L. Foutz, president of Copper Canyon, and associates.

Federal Uranium Corp. reports settlement of a suit in U. S. District Court in Salt Lake City brought by A. J. Pryor, Houston, Tex., "without expense" to Federal. Lester A. Harrison, Federal vice president, said the Pryor suit, which has been withdrawn, claimed an undivided one-half interest in the $21-million Radon orebody, Big Indian District, San Juan County.

Pryor was one of the original locators of the uranium claims. Hecla Mining Co., operator for Federal, was made a party to the suit. Dismissal of the action gives Federal complete ownership of the orebody, subject only to a 15% royalty, of which Federal, itself, owns 7½%. Hecla currently is shipping 200 tpd uranium ore from the mine.

Comstock Uranium and Tungsten Corp. reports a substantial discovery of chromite ore in the old Haggard-New mine 180-mi west of Boise, Idaho, near John Day, Ore. C. G. Cafarelli, president and Dorsey Hager, geologist for the company, said the chromite lens was found at end of a 300-ft tunnel. Values are placed as high as 48% metal in ore in places.

The pair say that geologic inferences indicate the new orebody, into which tunnel has been extended 16 ft, is connected with a discovery made in the old Haggard-New workings through sinking of a winze.

The lenticular orebody making in dunite and serpentine is some 77 ft from tunnel contact with the ore found in the winze. Dip is more than 60 deg. Orebody has an inferred reserve of between 15,000 to 20,000 (long) tons, Comstock officials report.

Banner Mining Co., just hitting its stride in mining and milling in the Pima, Ariz., copper district, will report more than $800,000 in earnings before taxes for the 10 months completed Oct. 31, 1955, according to reliable sources in Salt Lake City. Majority shares in the firm are held by Tintic Standard Mining Co., Rico Argentine Mining Co. and Bonneville-on-the-Hill Co., all of Salt Lake City.

Four Corners Uranium Co. has presented the Atomic Energy Commission's Grand Junction Operations Center with a proposal for a uranium mill at Green River, Utah. Commission has started tentative negotiations on this proposal, even though main mine to serve the area appears to be the Hidden Splendor property (Pick mine) on the Muddy River, which by contract is dedicated to sell ore to Vitro Uranium's Salt Lake mill.

AEC at Grand Junction also confirmed that a "partial proposal" for a mill at Green River had been submitted to the agency by Union Carbide and Chemical Corp. (Nuclear Division). Union Carbide sometime ago secured land near the Green River for such a mill.

Phillips Petroleum Co. reportedly has paid as high as $1-million for 115 uranium claims in the Pumpkin Buttes area of Wyoming. Sale was made by State Mines, Inc., Lander, Wyo. Royalty of 5% on the gross was maintained by State Mines. None of the claims have seen extensive development.

Royal Uranium Corp., Salt Lake City, has discovered a new orebody in a freak of mining at its Indian Creek district property, San Juan County. George H. Patterson, Royal president, said that a second ventillation shaft, in 600 ft from the first such shaft, was being raised 40 ft to the surface when very high grade ore was found about 10 ft below ground.

While no development has been pushed on the discovery, it appears to rest in a Shinarump channel about 5½-ft thick at point of contact. Some of the uraninite assayed chemically at up to 18% uranium oxide.

Five States Uranium Corp. of Albuquerque, N. M., was striving in January for a 25-tpd shipping schedule from its Dirty Devil mine on the San Rafael Swell. Orebody was reached by a 200-ft drift just before Christmas.

WASHINGTON

Dawn Uranium and Oil Co. recently announced completion of a 19-hole drilling program indicating commercial value uranium ore is present on its new Curtin lease in Mount Spokane district. Further exploratory work will be required to learn the size of the deposit. Wagon drill holes indicated ore lies from 15 to 50 below surface.

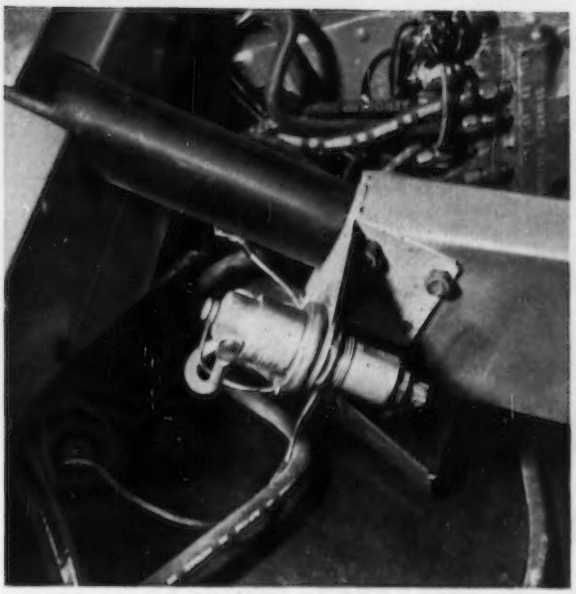
Organized in May 1955 by Canadian and Spokane men, Dawn will apply for a Government loan to finance deeper drilling on Wieber-Wisemore lease several miles north of Curtin lease. Promising mineralization has been indicated by diamond drilling.

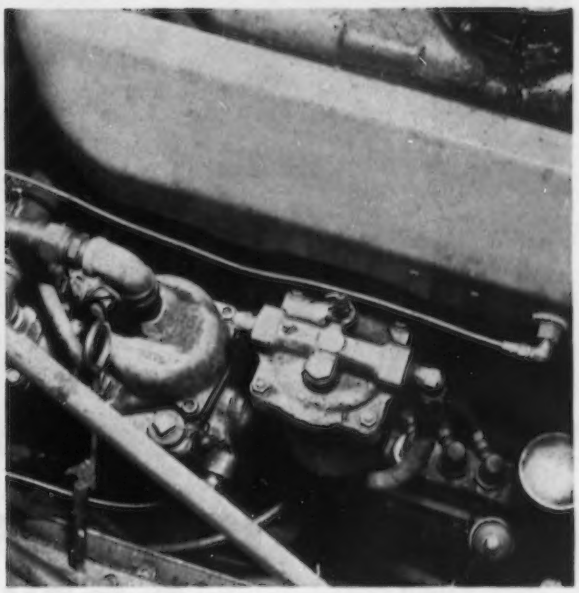
Yreka Mining Co., Spokane, has acquired 200,000 shares of Western Resources, Inc., Spokane, which controls a new uranium find 2 miles east of Saltese,

The Engineer's Field Report

CASE HISTORY
PRODUCT Chevron Pressure Primer System
FIRM Consolidated Freightways Inc., Portland, Oregon

Pressure Primer System starts diesels on 1st or 2nd turn with regular batteries—at minus 40°





BELOW ZERO starting temperatures are common 5 months a year for Consolidated Freightways equipment operating in Mountain and Plain States. Two hundred and forty-four of the company's tractors are equipped with the Chevron Pressure Primer System. Since this installation, rigs start on first or second turn at 40° below zero—using regular equipment batteries! Normally in these sub-zero temperatures, regular batteries give out after about 4 turns. Sure starts plus the fact engines are primed with Chevron Pressure Primer bulbs, controlled from within the cab, saves Consolidated Freightways important man-hours and speeds operating schedules. Picture above (left) shows a Chevron Pressure Primer Discharger mounted on steering column. Highly volatile priming fuel is atomized through tubing into manifold (right) under 250 lbs. pressure.

FREE FOLDER tells you more about Chevron Pressure Primer System and how to install it on different engines. Write or ask for it today.

CHEVRON

TRADEMARK "CHEVRON" REG. U. S. PAT. OFF.

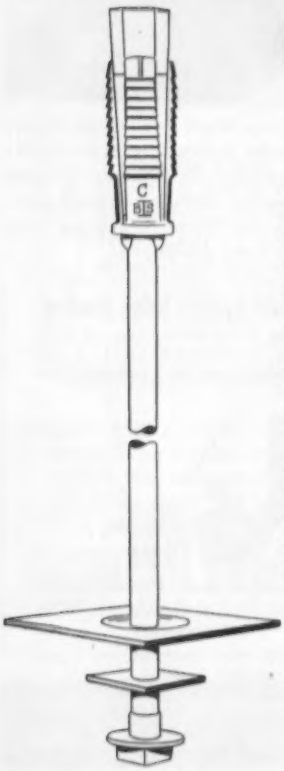
FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

Why Chevron Pressure Primer System helps starting

Volatile Chevron Priming Fuel atomizes in induction system at temperatures as low as -65°F. Pressure or weakest spark from engine fires mixture.

Simple, rugged discharger prevents fuel leakage. Small, safe steel bulbs protect fuel from water and dirt.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado



Here's the Way to Obtain a Sound Mine Roof

An ideal way to obtain sound roof in the mine is to anchor overlying layers of rock by means of the Bethlehem square-head roof bolt. This method of roof control promotes safety, and makes possible increased production through greater maneuverability of mechanized equipment. Ventilation improves, because there are no bulky supports. Less storage space is required.

The Bethlehem square-head roof bolt comes in ¾-in.-diam carbon-steel and ⅝-in.-diam high-strength types, both of which have a typical breaking load of 24,000 lb. It is also made in a ⅞-in.-diam high-strength type, having a typical breaking load of 45,000 lb.

All three bolts are used in conjunction with expansion shells, which provide positive locking action against the sides of the hole when the bolt is tightened. A hardened washer reduces friction between the bolt head and the roof plate, which is caused by high tension in the bolt producing excessive bearing pressure. The washer also permits free use of impact wrenches, without galling or tearing of metal.

If you would like to look into the advantages of a roof-bolting program in your mine, drop a line to the Bethlehem sales office nearest you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Washington *(Continued)*

Montana. Bulldozer trenching indicates an orebody from 35- to 70-ft wide and 300-ft long.

Yreka holds an option on 800,000 additional Western shares, and if taken up, the shares would give Yreka 50% ownership of western. Western Resources got the property from prospectors.

Yreka has been inactive since 1945 when New Hilarity Mining Co. undertook a deep development program at Yreka's lead-silver prospects east of Kellogg, Idaho. New Hilarity has been trying to obtain financing to complete the program.

Daybreak Uranium, Inc., completed shipments in December on a 500-ton contract with the AEC for ore from its open-pit autunite development in the Mount Spokane area. During next six months company plans shipments under a 5400-ton contract with Vitro Uranium Corp.

Company has transferred most of its equipment to two locations on the Spokane Indian Reservation; Lowly and Bair leases. Core drilling began in December on Lowly lease. A bulldozer cut in Bair lease showed 0.48% uranium oxide. Daybreak now holds 2500 acres on the reservation by lease or mining permit.

Daybreak plans to fulfill the Vitro contract with ore from all three locations, two on the reservation and the third near Mount Spokane on property leased from Alfred Dahl, a farmer whose sons located radioactive ore on his land. Forty five carloads of ore were shipped during 1955 from the Dahl properties.

Daybreak plans to begin development of other Dahl property and 2200 acres of new leases in Ferry county, north of its present workings, in the spring.

James F. Fox, president, also announced plans to recover copper from water pumped from five California mines beginning immediately. Daybreak will use a leaching plant built in the twenties to recover an anticipated 43% copper concentrate by running water from the mines over beds of burned tin cans.

Fox said the mines have not been pumped out since they were flooded in the thirties. He identified them as properties leased from the Calaveras Copper Co., at Copperopolis in the Mother Lode district 23 miles east of Stockton, Calif. A special pump has been installed to take water from more than 30 miles of old tunnels.

Daybreak has purchased 60% of the stock of Union Copper Co., which will undertake the copper recovery program under the direction of Fred Arisman, Copperopolis, former mill superintendent at the Turk Mine in Stevens County, Wash.

Old Frontier Uranium, Inc., of Green River, Utah, has begun an exploration program in northern Lincoln County, Wash., south of the Spokane Indian Reservation. Don D. Murphy, president, said firm holds "extensive acreage" near the Spokane River, north of Davenport, and has begun a bulldozing and drilling program in search of uranium ore. Old Frontier holds 231 claims in

Why a V-Belt with

CONCAVE SIDES

wears longer

It is easy to demonstrate to yourself why the concave sides (Fig. 1) of the Gates belt greatly lengthen belt life.

Simply bend a Gates belt and feel the sides. Notice how these precisely engineered concave sides *fill out* on the bend and *become straight.* Thus a Gates belt grips the sheave groove evenly (Fig. 1-A) and wear is distributed uniformly across each side of the belt. That means longer belt life; lower costs.

Make the same test with a straight-sided belt (Fig. 2) and see what happens. The sides bulge out on the bend (Fig. 2-A) concentrating the wear at points shown by arrows.

To assure longer wear and keep belt costs down, specify the V-belt with concave sides—Gates Vulco Rope . . . readily available from nearby distributor stocks. The Gates Rubber Company, Denver, Colorado —*World's Largest Maker of V-Belts.*

There are Gates Engineering Offices and Distributor Stocks in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

TPA 66

Gates VULCO ROPE Drives

This Screen Guard can be used in any mining and industrial field and is particularly adaptable for use in flumes. Only the finer particles pass over the screen.

mining

foods

WEDGE WIRE PREPARATION SCREENS AND SCREEN GUARDS PERFORM WITH

top efficiency

chemicals

abrasives

oil

The trade name KLEENSLOT stands for high quality precision made screens, giving top performance and efficiency in screening, dewatering, washing, extracting, filtering, or sizing applications. They are made of specially formed wedge shaped wire to afford clear rapid passage of materials and to eliminate blinding. Highest production is the greatest feature of WEDGE WIRE products. Write for literature!

WEDGE WIRE Vibrator Screens can be designed to fit any make of vibrator.

Wedge-Wire CORPORATION
Gas Street at Nickle Plate R. R.
Wellington, Ohio

Washington *(Continued)*

San Rafael swell in Wayne and San Juan counties, Utah.

Northwest Uranium Mines, Inc., operating company for Fortune Mining, Eastern Lead and Silver Buckle of Wallace and Pathfinder Uranium of Salt Lake City, has exposed a mineralized area on its uranium prospect on the Spokane Indian reservation in southern Stevens County. The ore zone has been partially exposed for a distance of 600 feet from north to south and 1200 feet from east to west without reaching the ore limits in any direction. Best mineralization, ranging from 0.67 of 1% to 1.12% uranium oxide, has been found in fracture zones in the exposed area, but intervening beds of arkosic conglomerates, sandy claystones and clayey sandstones, with lignitic partings, have been found to carry lower-grade mineralization, and drilling exploration will soon get underway to determine whether the entire area is suitable for a large open-pit operation.

WYOMING

Dist. Judge G. A. Layman of Wyoming's fourth district has thrown out of court a petition by the Pumpkin Buttes Mining District to require filing of claims with the district recorder. Layman sustained a demurrer on technical grounds petition did not state facts sufficient to constitute a cause of action. Action did not clarify the district's legality.

Mining district was formed Nov. 7 by a group of ranchers and prospectors claiming to represent their respective interests. Group formulated a set of rules designed to insure orderly opening of 46,440 acres of public land to claim filing Nov. 17.

District claims it is the legal recorder of claims on the Pumpkin Buttes area land, not the County Clerk. Michael Hoch of Gillette, attorney for mining district, said he planned to file an original mandamus action in Wyoming Supreme Court.

Several smaller oil and uranium firms in Wyoming's Clareton Oil Field and San Juan County, Utah, have announced consolidation. New company, to be known as Wycotah Oil and Uranium, Inc., reportedly would be worth $5-million. Firm has filed with the SEC an amended registration statement covering more than 2-million shares of common stock. Prospectus shows company plans to issue stock in exchange for oil and gas leases and interests in uranium properties in Wyoming, Colorado and Utah.

A half million shares will be used to acquire stock of the Shootering Creek Mining Corp., which owns Ekker Uranium mine in San Juan County, Utah. Firm is being promoted by two Newcastle, Wyo., men, H. O. Beadle and E. E. Petersen. They will remain substantial stockholders.

The Wyoming State Journal has reported sale of 115 uranium claims in the Gas Hills and Pumpkin Buttes areas of Wyoming. Seller is State Mines, Inc., Lander, and buyer is Phillips Petroleum Co., Bartlesville, Okla. The bi-weekly newspaper said price was $1-million.

Power Gypsum Mining and Manufacturing Corp., Lander, Wyo., expected to begin production by Jan. 1. New plant will produce agricultural gypsum.

One of the mine's owners, Walter Bode, estimated gypsum beds south of Lander contain at least 1-million tons gypsum.

IN CANADA

Canada's mining industry in 1955 climbed to an all-time record of production which took at least $1.7-billion of new wealth out of the ground and sent mining dividends to a 24% increase over 1954.

The record production meant an increase of more than $200-million more than 1954, and the 1955 dividends totalled $156.1-million, up $29.9-million over 1954.

Year-end surveys revealed all-time records were registered by nickel, copper, iron ore, uranium, petroleum, building materials, and a host of other minerals.

Copper, iron ore, and uranium, provided the brightest headlines; copper stimulated by marked increases in its price, iron ore by growing mines, and uranium by the continued development of the Beaverlodge, Blind River, and Bancroft camps.

Included in production estimates this year for the first time, uranium output reached roughly $48-million in 1955, and is expected to hit $200-million or more within the next few years. Iron ore output, bolstered by full year production from Labrador-Quebec, totalled 14-million tons in 1955 with value in excess of $100-million.

The most significant feature of Canadian mining, however, was that almost all divisions of the industry were headed for still greater records. New base metal mines are being established in Newfoundland, New Brunswick, Chibougamau, Manitouwadge, Pine Point, and at Granduc in British Columbia. Iron ore is headed toward production twice, or even three times, as large as that of 1955 a few years hence.

Uranium, with half-a-dozen or more lines likely to be added to the present list of producers is slated for major status as a Canadian metal. And a long list of other lesser minerals gives promise of similar expansion.

NEWFOUNDLAND

Iron ore output of the province during 1955 will be about 8-million tons. Iron Ore Co. of Canada swung into full production during the year. According to observers fluorspar output will pass 135,-

Ametron® ELECTRONIC
CRANE SCALE

Weighs heavy loads suspended from crane hook. Printer, located in crane cab or other convenient location, records weight on tape or cards. New compact printer only 22″ x 18″ x 10½″.

Entire assembly designed for prompt and easy installation. Now available at new low cost. Capacities 5, 10, 15 tons.

Write for free Ametron Brochure F-5

STREETER-AMET CO.
4101 N. RAVENSWOOD AVENUE
CHICAGO 13, ILLINOIS
Branches in Detroit, Pittsburgh, Allentown, Birmingham and Los Angeles

THE STANDARD OF ACCURACY SINCE 1888

designers and builders of equipment for basic industries

IMMEDIATE DELIVERY
VALVES

McNally Pittsburg valves are made of the finest selected materials for high resistance to the corrosive action of sludges, slimes and slurry waters.

McNally Pittsburg valves are made in a wide range of sizes for both hand and motor operation. Recommendations for the best type for your needs will be made on request.

For Basic Industries McNally Pittsburg offers:

• SERVICES •
Engineering Design Field Erection
Research & Development

• EQUIPMENT •

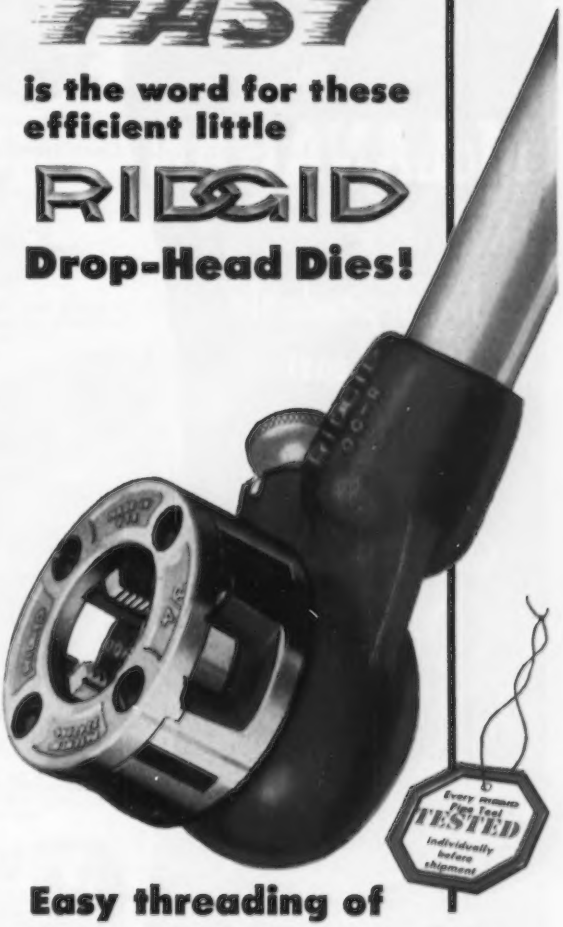
Conveyors	Pug Mills
Crushers	Screens
Dryers, Centrifugal and heat.	Pumps, Valves, Piping
Washers, heavy media and jig	Car Hauls, Dumpers
Kilns	

McNALLY PITTSBURG
MANUFACTURING CORPORATION

• OFFICES •
Pittsburgh, Pa.
First National Bank Bldg.
Chicago, Illinois
307 N. Michigan

• PLANTS •
Pittsburg, Kansas
Wellston, Ohio

FAST
is the word for these efficient little
RIDGID
Drop-Head Dies!



Easy threading of
⅛″ to 2″ pipe or conduit

Snap size head you want into ratchet drive ring, from either side—it can't fall out. Dies reverse easily for close-to-wall threading. 00R and 0R, ⅛″ to 1″; 111R and 11R, ⅛″ to 1¼″; 12R, ⅛″ to 2″. Free carrier with sets. Conduit and special dies available. Real work-savers—at your Supply House!

RIDGID Bolt Threaders, too—No. 00R-B, ¼″ to 1″, National coarse and fine thread, efficient drop-head dies.

"Threaded Pipe—*It's Tight—It's Best*—Costs Less"

RIDGID
Work-Saver Pipe Tools

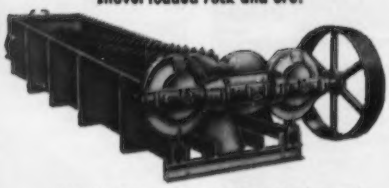
The Ridge Tool Company, Elyria, Ohio, U. S. A.

Specify
McLANAHAN
EQUIPMENT
for dependable
low-cost
FEEDING,
CRUSHING,
CLEANING in
PITS, MINES
and QUARRIES

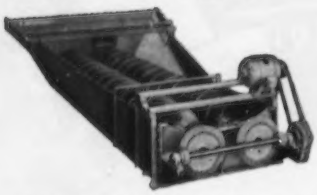
A pioneer in the development of many types of processing equipment, McLanahan has served domestic and foreign pits, mines and quarries for more than a century. Shown are a few illustrations of McLanahan equipment for crushing, washing, sizing and conveying all types of ore, rock, coal and other materials. Technical details and price information will be sent upon request.

All Steel Rockmaster Single Roll Crusher for primary or secondary work on shovel loaded rock and ore.

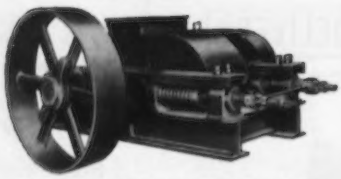
Heavy Duty Reciprocating Plate Feeder. Handles any materials from sand sizes to shovel loaded rock and ore.



Log Washer for removing tough clay and soft rock from various materials.

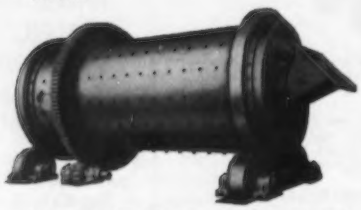


Double Screw Washer (with gear cover removed), for dewatering, classifying and removing waste from sand, limestone and other materials.



Heavy Duty Fabricated Steel Double Roll Crusher for secondary reduction of rock and ore.

Double duty combination Scrubber and Sizing Screen for large and small capacities.



Paddle Mill Scrubbers of various capacities for cleaning large size feed.

write today for complete information

McLANAHAN & STONE
CORPORATION
PIT, MINE AND QUARRY EQUIPMENT HEADQUARTERS SINCE 1835
215 Wall Street, Hollidaysburg, Pennsylvania

Newfoundland *(Continued)*

000 tons metallurgical grade material in 1955. Copper mining companies are expected to be in production by 1957. Year was an active one for exploration, with eight companies doing exploration work in addition to programs of the Geological Survey.

QUEBEC

Lithium led the field in interest during 1955 with Quebec Lithium Corp. getting into production late in the year. Total mineral production passed the $300-million mark, with metals accounting for $126-million. Asbestos production will be about 900,000 tons for the past year.

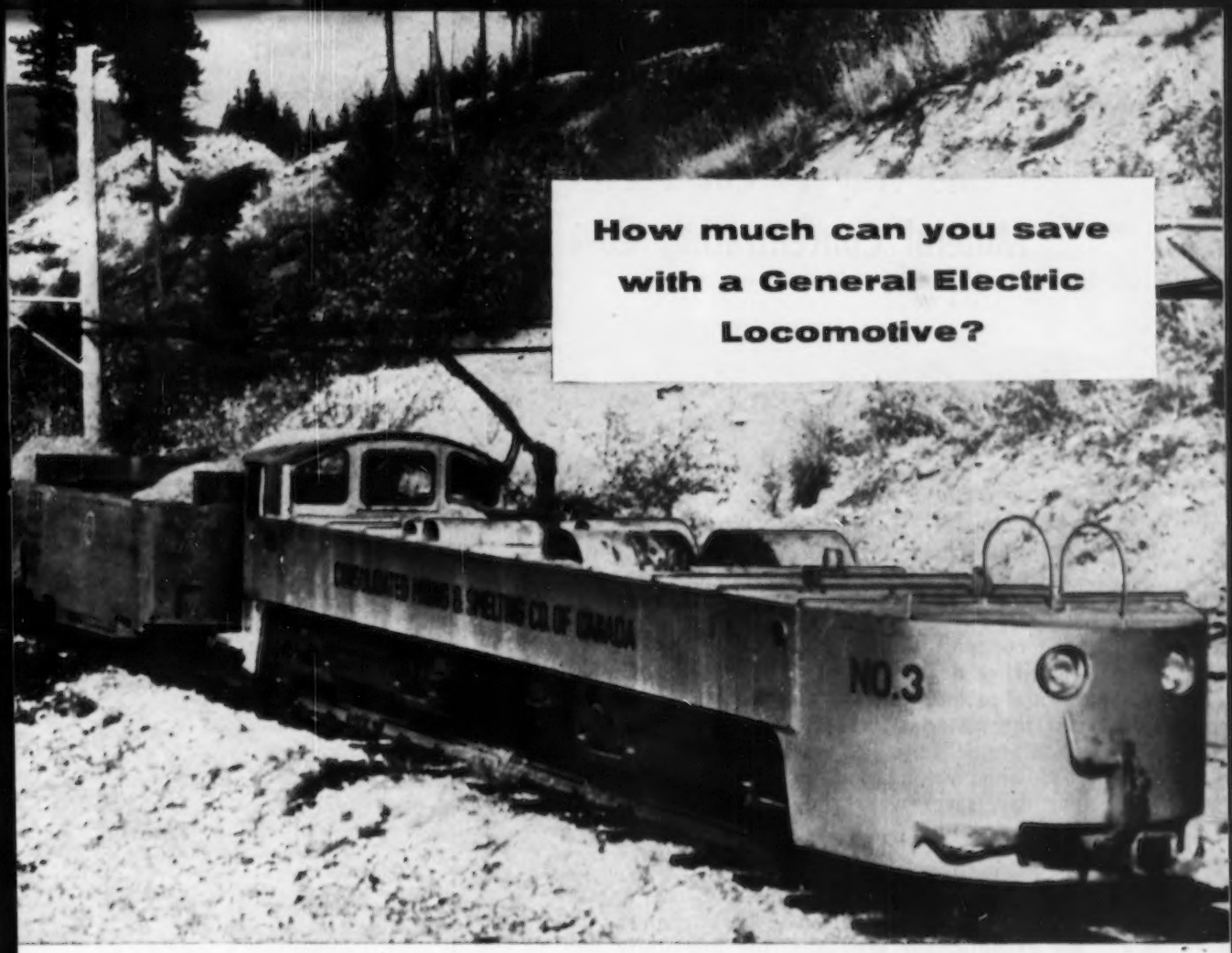
Lateral development work has been started on three levels at the copper property of Duvan Copper Co. in Desmeloizes Twp. following completion of shaft sinking. Work is being primarily concentrated on the 350-ft level, where the copper zone is expected to be reached in about 150 ft. On the first or 250-ft level, the zone should be reached after an advance of 130 ft and on the bottom or 450-ft level about 185 ft of advance will be required.

International Iron Ores Ltd. and Atlantic Iron Ore Ltd., under the direction of Cyrus T. Eaton, are moving closer to the production stage for huge low grade iron deposits in the Ungava area in the far northern section of the province. Companies hold a 760-sq mile concession between Hudson Strait and Ungava Bay. Extensive metallurgical tests conducted over the past few years by Cleveland-Cliffs Iron Co. in the U. S. have demonstrated that a premium grade concentrate can be made.

New structure is shaping on the copper property of New Royran Copper Mines in the north Dore Lake sector of the Chibougamau camp. New zone is about 1200 ft east and slightly south of the main, or Machin Point, copper zone for which shaft sinking and an underground program have already been laid out. A strike length of upwards of 800 ft has been outlined.

Brand new ore zone, termed the "E" area, has been indicated by drilling at the Dore Lake property of Campbell Chibougamau Mines in the Chibougamau. New zone is east of the "B" orebody and is contained in the same broad shear structure in which the "A" and "B" orebodies were found. The promising ground is located in the 36-acre area held under lease from the adjoining Merrill Island Mining Corp.

Downward extension of the main gold orebody at the Malartic area property of East Malartic Mines has been indicated as continuing strong to the present bottom, or 19 level. Widths in initial outline drilling have averaged above 85 ft with uncut grade as high as 0.716 oz gold per ton. Success is also being achieved in the development of the new



G-E Locomotives Help Consolidated Mining and Smelting Company Reduce Their Ore Haulage Expense

At Kimberly, British Columbia where the Consolidated Mining and Smelting Co. of Canada, Ltd. works the largest lead zinc mine in the world, three G-E 40-ton swivel-truck, trolley locomotives move about 11,000 tons of ore per work day—faster and at lower cost, too.

Designed for heavy duty, high-speed haulage, these powerful, swivel-truck mine locomotives have three outstanding advantages:

1. **Low weight per axle**—Locomotive weight is carried by four axles, thus reducing the concentrated load on the rails and decreasing the lateral forces imposed on the track.

2. **Short rigid wheel base**—The short rigid wheel base of the trucks, their low inertia, and their swivel connection to the locomotive frame permits the wheels to follow the rails freely. This reduces binding and straining on both the locomotive and the track.

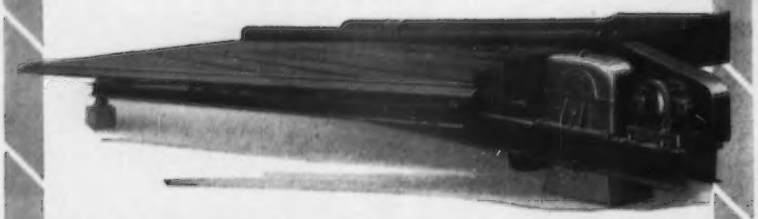
3. **Short overhang at ends**—The long distance between the points at which the locomotive body is supported compared to the overhang at either end, prevents teetering or galloping and promotes smooth riding.

WHAT ARE YOUR HAULAGE REQUIREMENTS? From the wide range of G-E industrial and mine locomotives—diesel-electric and straight electric, for both underground and surface haulage, there's one that's fitted to your needs. For a survey of your haulage requirements, without cost or obligation, contact your G-E Apparatus Sales Engineer. Locomotive and Car Equipment Department, General Electric Company, Erie, Pa. 120-79

You Get
Longer Life,
Better Performance,
Lower Cost
WITH ELECTRIC DRIVE!

GENERAL ELECTRIC

One Way to Cut Your Mineral Concentrating Cost



The SuperDuty® DIAGONAL-DECK® Concentrating Table enables you to cut your concentrating cost while producing exceptionally high grade concentrates at maximum recovery.

The concentrating efficiency results partly from the riffled deck designed to take advantage of the natural path of the pulp across the deck. This fans out the material for better separation and more accurate delivery. The resulting reduced middling load, while making room for more tons of new feed per day, saves wear and tear on re-circulating equipment.

A new, but long-proved, smooth-running head motion and factory aligned under-construction contribute further to efficiency. Maintenance costs are exceptionally low. Yes, the Superduty definitely cuts concentrating costs while producing exceptional concentrate quality. Send for Bulletin 118-B.

CONCENCO® Type "CPC" Classifier

This all steel Constriction Plate Classifier is available in 1 to 10 or more cells. Novel secondary classification sharpens the separations made by each cell. Advantages offered are: (1) Sharp separation, (2) accurate classification, (3) as many spigot products as there are cells, (4) continuous discharge, (5) no moving parts, (6) low maintenance cost.

THE DEISTER ★
CONCENTRATOR
COMPANY
903 Glasgow Ave. • Fort Wayne, Ind., U.S.A.
CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

Quebec *(Continued)*

ore area west of the Sladen Fault on the 18th level.

Merrill Island Mining Corp. is preparing for shaft deepening on its main copper-gold property in the Dore Lake sector of the Chibougamau camp. Objective of the current program is to open four new levels down to the 1,000-ft horizon below the existing two levels at 150 and 300 ft. Two diamond drill rigs are also being used to test a new ore-bearing structure.

ONTARIO

Latest estimate of value in Blind River conglomerate is $3-billion worth of uranium. With the rush for uranium, Ontario led the way in Canadian mineral development during 1955. Pronto Mines started producing uranium concentrate in October. Coupling Pronto with Gunnar Mines in Saskatchewan and Beaverlodge made Canada the second ranking uranium producer in the world. By the end of 1958, Canada will be producing about $180-million worth of uranium annually.

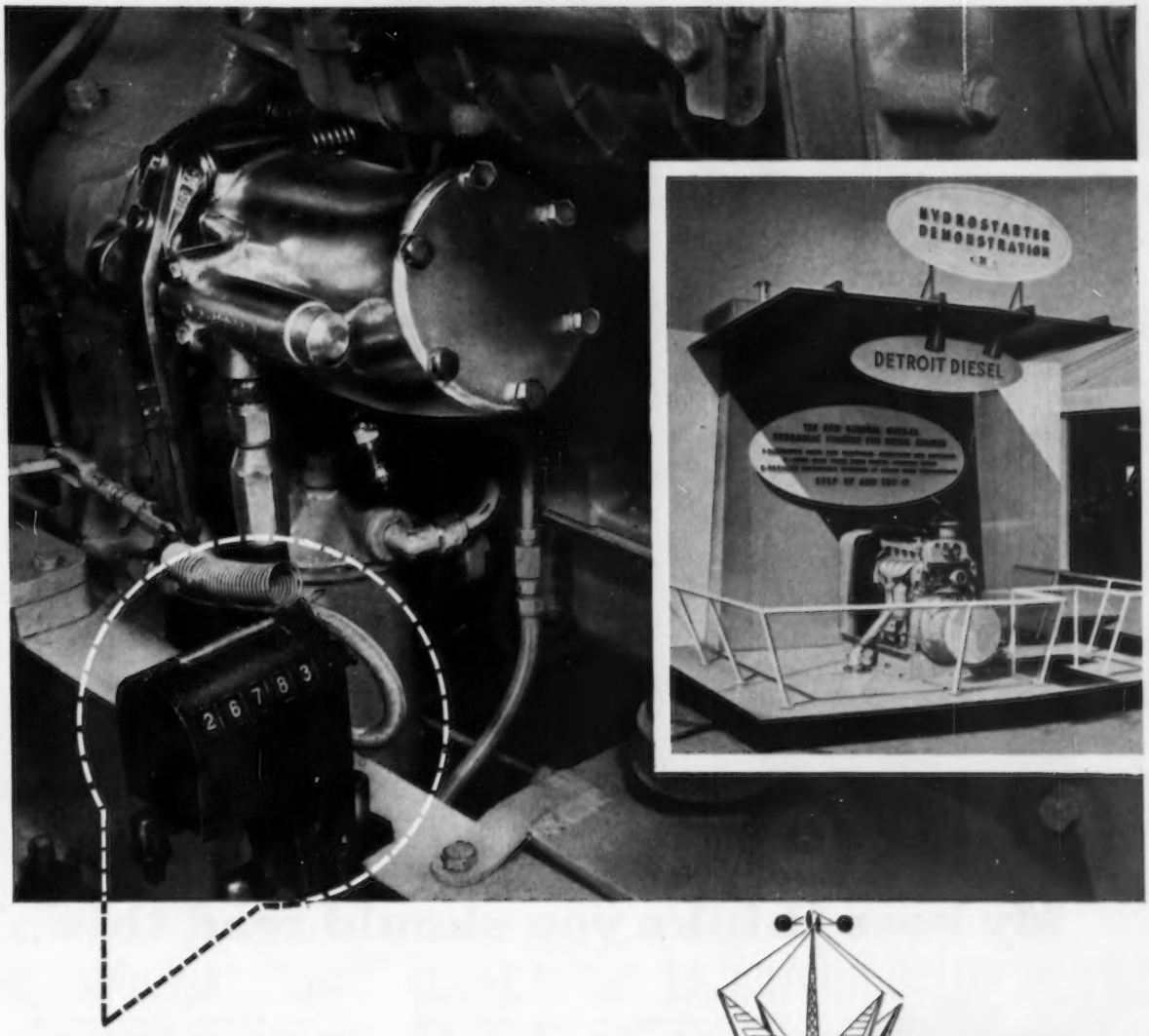
The world output of nickel during 1955 has been estimated to be 212,000 tons, of which Canada and mostly Ontario, accounted for 80% or more. Production of copper and lithium will increase in 1956, along with nickel and iron ore from Marmaraton Mining Co.

Big tonnage Sudbury district base metals-gold-silver property of Consolidated Sudbury Basin Mines may go into production soon. Present thinking is that, initially, a mill of 3,000 tpd capacity will be installed. Currently work is under way at two shafts at the Errington mine; at Vermilion Lake, about 5 miles to the west, preparations are being advanced for deepening the No. 4 shaft.

Good progress is being made in outlining a lithium orebody at the property of Aumacho River Mines in the Georgia-Cosgrave Lakes area, some 25 miles south of Beardmore. Diamond drilling has indicated two parallel lithium-bearing dikes for a length of about 600 ft and depth of 330 ft, both still open.

A unique operation is to be undertaken by Aunor Gold Mines at Porcupine area mine. In order to open up ore, which lies some 3,000 ft away from the main shaft, Aunor will drive two parallel raises from the 1,000-ft level right through to surface. The larger of the two raises, which will be only 10 ft apart, is 7.5x11 ft, while the smaller will be 5.0x6.0 ft. In addition 16 cross-overs will be driven.

In the Kirkland Lake camp, Sylvanite Gold Mines has started a long exploration drive to the east from its bottom level at 5500 ft to test the adjoining gold property of Arcadia Nickel Corporation. The 343-acre Arcadia group was formerly operated by Toburn Gold Mines. The drive has about 1400 ft to go for an initial diamond drill station.



26,783 Starts in 26 days at GM Powerama!

HERE'S PROOF of the rugged dependability of a General Motors Hydrostarter—the new, low-cost hydraulic starting system now available on all GM Detroit Diesel engines:

> On public demonstration at the GM Powerama, a Hydrostarter started a GM Detroit Diesel 26,783 times in 26 days—an average of more than 1,000 starts per 12-hour day—more than 1 start every minute.

A Hydrostarter gets a GM Detroit Diesel up to starting speeds 80% faster than regular starting systems—costs less to maintain than electric starters—sells for a far lower price than any other non-electric Diesel starter.

And it gives you fast, sure starts—even at sub-zero temperatures, or when your equipment has been standing idle for long periods of time.

Call your GM Diesel Distributor for full details on the GM Hydrostarter—or write direct for more information.

DETROIT DIESEL

Engine Division of General Motors

Single Engines . . . 30 to 300 H.P.
Multiple Units . . . Up to 893 H.P.

America's Largest Builder of Diesel Engines

The following notes are quoted by permission from an actual letter written by one quarry operator to another...

My boss thinks you should read this...

YOU CAN'T BEAT THIS COMBINATION

...exclusive EASTON electric overhead dumping system and EASTON doorless pan trailer. EASTON trailer capacities range from 10 to 36 tons. For exceptional grades the EASTON pan body may be truck-mounted.

MY BOSS *is a very fair man. He has end dump trucks and side dump trailers and uses both on jobs for which they are suited. But, when another quarry man asked us what we find best for* straight quarry work, *here's what my boss dictated:*

"BOTH TYPES of trucks are required to meet our operational requirements. Were ours a straight quarrying operation, we undoubtedly would favor the side dump trailer units for the following reasons:

"1—Side dump trailer units carry greater pay loads using the same truck as a tractor that is used with the end dump bodies (side dump unit capacity, 35 tons,—end dump unit capacity, 22 tons).

"2—Less spillage experienced hauling 35 tons with side dump units than 22 tons with end dump units (attributed to backs on the side dump trailer units).

"3—Shovel operators claim that loading the side dump units is easier.

"4—Though our roads are maintained for the very best of haulage conditions, racking of loads could be a problem, and in this instance longer unit chassis life should be experienced in the trailer type haulage unit through the better load distribution and the trailer universal action at the tractor hitch.

"5—Dumping at the crusher takes about the same time for both units. The side dump units are dumped by a push-button controlled electric overhead hoist, operated by an attendant at the crusher."

EASTON®

EASTON CAR & CONSTRUCTION COMPANY • EASTON, PA.

A good haulage system must provide efficient dumping. For the most efficient system you can own get the advantages of EASTON's exclusive background of experience and the EASTON automatic electric overhead hoist. B-1071

CABLE AND MINE EXPERIENCE enable Anaconda to design and build shovel cable that resists razor-sharp rocks, water, sun, heat, cold, and — most important — run-overs.

This cable was "built" in our mines to perform better in yours

If you were a cable manufacturer as well as a miner, you could use your mine experience to build cable better than others.

But since you aren't, it will pay you to buy your cable from Anaconda—who *is* both cable manufacturer *and miner.*

FOR SHOVEL CABLE

Years of mine experience . . . of cable testing and improving . . . have taught us how to make a cable that *stays on the job longer under all conditions.* It's Securityflex* Type SH-D cable.

New, job-tested, high-grade butyl insulation assures better resistance to heat, water and compression. And new neoprene jacket makes this cable even tougher and more abrasion-resistant.

For Type SH-D, *or other shovel cable,* let Anaconda mine and cable experience pay off for you. See your Anaconda Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 60321

*Trade Mark

ANACONDA®
MINE CABLE

FLAT-TWIN CABLE

Improved stranding, new insulation, new grounding wire, and neoprene jacket make this a superior cable for shuttle cars, continuous miners, loaders, drill trucks, cutters.

POWER CABLES

AnacondA Types W & G are rugged, sturdy and long-lived. Used for mine power, shovels, continuous miners, loaders, drill trucks, cutters.

SHOVEL AND DRILL CABLES

Securityflex* Types W and G are used with small shovels, self-propelled drill trucks, pumps and a-c mining equipment. For higher voltages, Type SH cables (shielded) are recommended.

SECURITYFLEX CORDS

Unexcelled for strength, wear resistance and long life. Type SO (heavy-duty) provides superior service on remote control and hand drills.

TROLLEY WIRE

FEEDER CABLE BARE OR INSULATED

TELEPHONE WIRE

SHOT-FIRE CORD

WELDING CABLE

SAFETY INSURED—When a 41,300-lb. section of stone crushing equipment was placed by an American 700 Series Crawler Crane, Crosby Clips were used on all wire ropes to assure maximum safety for men and equipment. Genuine drop-forged, hot-dip-galvanized Crosby Clips, with the famous Red-U-Bolt, are specified for safety on more jobs than any other drop-forged wire rope fasteners.

STRONG SAFE, BLOCK

When cofferdam sheetings were about to be drawn from the sucking, grasping soil of the Platte River bottom, a Load-Rated Crosby Crane Block was specified. Made of highest-quality steel, and engineered for safety as well as efficiency, Crosby Blocks are backed by the famous Crosby name—recognized leader in safety. When using Crosby Blocks, workmen can't go wrong, for the safe lifting capacity is embossed right on the side plates.

EASY TAKE-UP

Important design advances by the makers of famous Laughlin Turnbuckles offer added safety and efficiency to users in the construction field. Laughlin Turnbuckle bodies have extra-heavy hex ends which allow fast, easy take-up with a wrench. An exclusive eye design takes the ear of a shackle one size smaller and is stronger than conventional eyes because it conforms more closely to the lines of pull. This design also makes it easier to attach thimbles and other fittings. Exceptionally strong, Laughlin hooks have added heft at points of greatest stress—the ¼-inch hook is actually stronger than most ⅜-inch hooks. Available in a complete range of sizes. A reference chart in Laughlin's free catalog lets you select the proper size turnbuckle for each job.

ATTACH IN SECONDS

A more efficient clevis grab and slip hook made by Laughlin has a "Crimp Style", cotter that can be removed and attached in seconds. Available in a complete range of sizes at distributors everywhere, Laughlin Clevis Grab and Slip Hooks are made of drop-forged steel special forging quality and are heat-treated for maximum strength. For free catalog on the complete Laughlin and Crosby lines, write the Thomas Laughlin Division, Portland, Maine, or the American Hoist & Derrick Co., St. Paul 1, Minnesota.

NEW BRUNSWICK

Heath Steele Mines, the American Metal Co. subsidiary, is moving steadily toward early production at its property in the Little River area. Initial output from the rich lead-zinc-silver-copper deposit is planned at 1,500 tons per day. Two shafts are being used. The No. 1 has been completed to 540 ft; sinking of the No. 2 shaft is still in progress.

Brunswick Mining and Smelting Co. has almost completed outlining its large No. 12 orebody by crosscuts and drilling on the 350-ft level at its Bathurst area property. Orebody is 1200 ft long and at the higher grade north end has a maximum width of nearly 200 ft. At the southern end, where there is a fat lens parelleling the main orebody, total ore width extends over 250 ft. Crosscuts showed combined values of about 15% zinc and lead at the north end with grade about half that in the south end.

BRITISH COLUMBIA

British Columbia value of mineral production for 1955 has been estimated by Mines Minister Sommers at $174.5-million, which was close to the record high of 1951. It compares to $153,377,315 for 1954.

Last year's estimated production indicates moderate decreases in production of gold, silver, copper and lead, but "increased prices largely offset the reduction in quantity for gold, silver and lead, and for copper the value is considerably greater than in 1954," Mr. Sommers said.

The estimates also indicate an increase in the production of zinc, which together with the increase in price gives a value "materially greater" than in 1954.

The minister said the increase in value of the production of industrial minerals reflects increased production of asbestos and sulphur.

The 1951 record totalled $175,600,000.

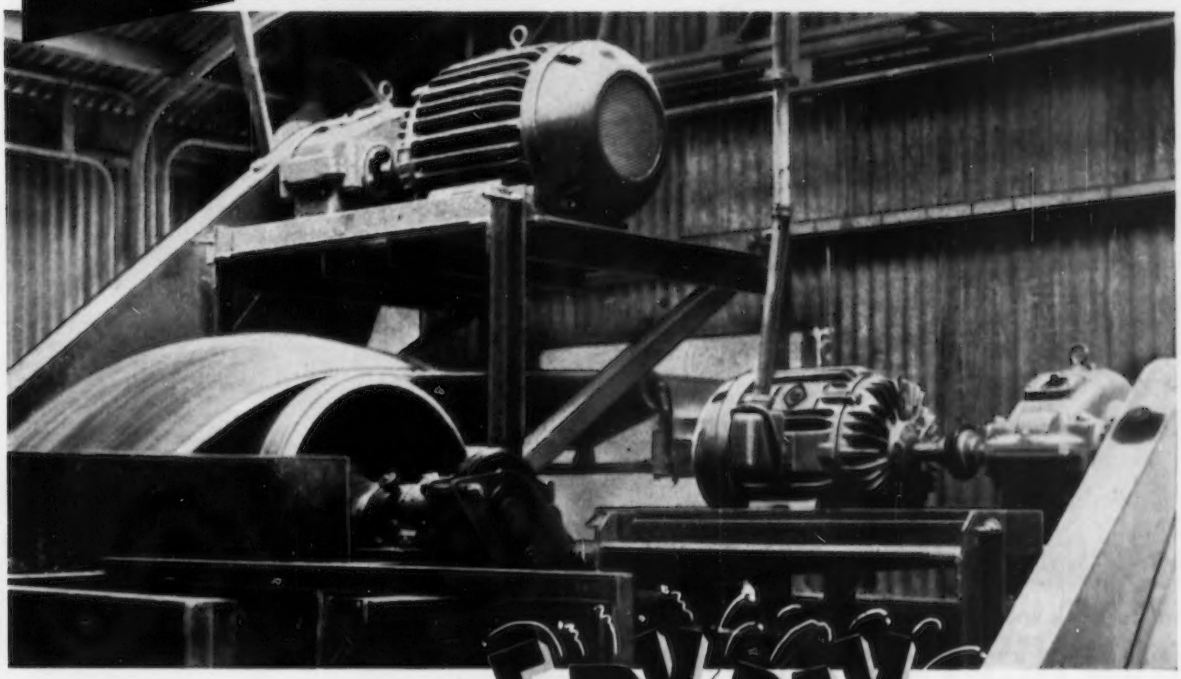
At that time, lead and zinc prices hit extremely high levels because of industrial activity and stockpiling in the U. S.

The estimated 1955 value for the major minerals with 1954 values in brackets:

Placer gold, $225,000 ($238,967); lode gold $8,200,000 ($8,803,279); silver $7.3-million ($8,153,108); copper $17,250,000 ($14,599,693); lead $44,750,000 ($45,482,505); zinc $51-million ($34,805,755); iron, tungsten and cadmium $12.2-million ($10,708,660); antimony, bismuth and tin $1.2-million ($1,156,060); industrial minerals, including asbestos, gypsum, sulphur and others, $7,250,000 ($5,877,881); structural minerals, including clay products, lime, limestone and cement, rock and building stone, sand and gravel, $15.5-million ($14,395,174); and coal $9.5-million ($9,154,544).

Forty-third annual meeting of the British Columbia & Yukon Chamber of Mines was held in Vancouver in mid-January. Henry L. Hill, consulting min-

There's **MORE** Cooling Surface in these deep-ribbed **MOTORS**



No Day is FRYDAY

with these Allis-Chalmers MOTORS

● Frying of insulation is impossible under normal conditions with the extra-large cooling surface of Allis-Chalmers rib-type TEFC motors. The result—you expect and get longer motor life.

The engineered partner of A-C motors is Allis-Chalmers control.

Get Complete Information

As a new machinery component or as replacement, specify Allis-Chalmers. Discuss your particular application with your nearby A-C distributor, A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-4920

LIMA

SHOVELS AND DRAGLINES

are geared to mining conditions

Down time in digging operations is costly—not only because of difficult on-the-job maintenance—but because down time of machines ties up costly labor and idles other expensive equipment. Lima shovels and draglines, with "built-in" stamina for the tough jobs, pay big dividends by assuring continuous operation with maximum output at lowest cost.

Painstaking care in every step of manufacture assures the quality of every part, long trouble-free service of every Lima machine. You'll be able to put a Lima to work and keep it working day in and day out with only routine maintenance.

Get complete details from your nearby LIMA distributor . . . or write Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.

COMPARE QUALITY! No other machine gives you as much as LIMA!

1. Sturdy unit-type construction.
2. Simple, rugged design.
3. Low center of gravity.
4. Long wide crawlers for greater stability.
5. Permanent shaft alignment.
6. Smooth running anti-friction bearings.
7. Ample power for big output.
8. Big capacity drums and sheaves are easy on cable.
9. Air-operated clutches on most models.
10. Large braking areas.

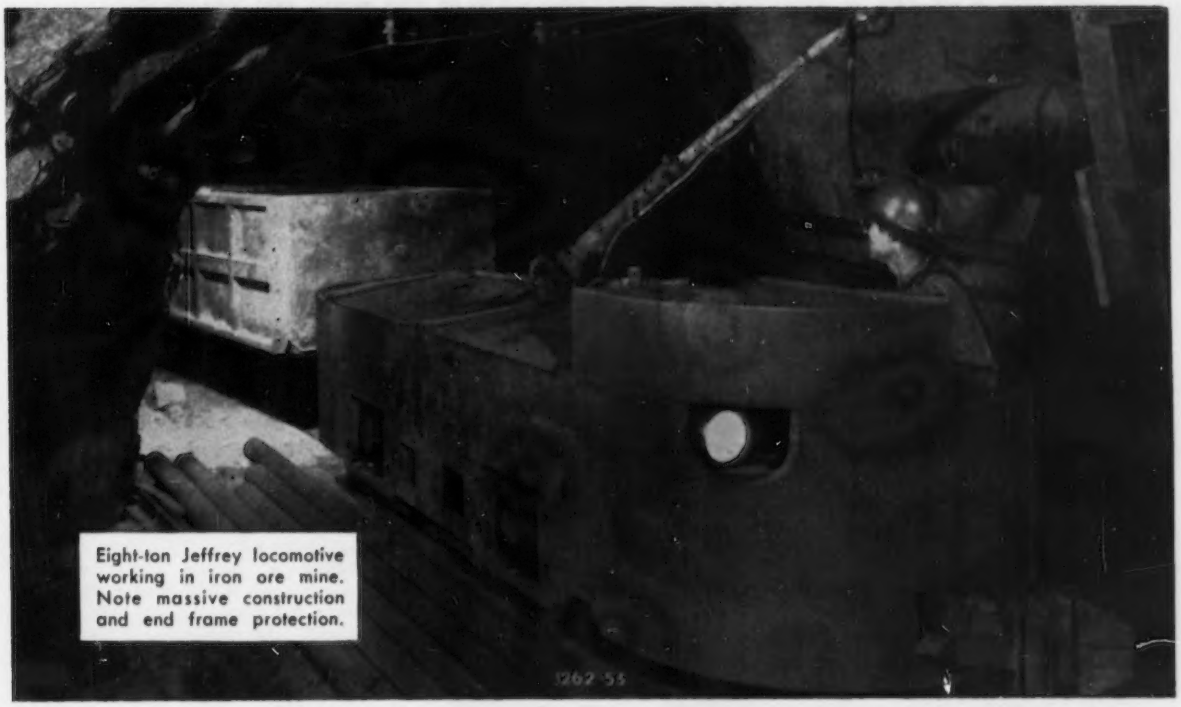
These are only a few of the features which help you *strip more, dig more* and *load more* with a LIMA. There's a type and size for every job—shovels to 6 yds., cranes to 110 tons and draglines variable. Smaller capacities on rubber.

DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

LIMA SHOVELS · CRANES · DRAGLINES · PULLSHOVELS

BALDWIN-LIMA-HAMILTON

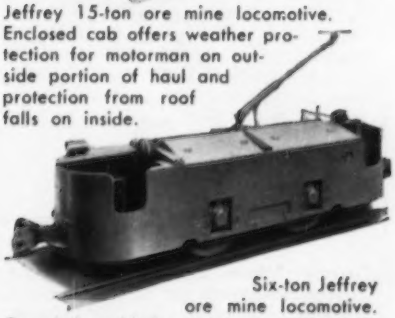
Construction Equipment Division · LIMA · OHIO · U. S. A.



Eight-ton Jeffrey locomotive working in iron ore mine. Note massive construction and end frame protection.

Jeffrey Trolley Locomotives improve metal mine haulage

Jeffrey 15-ton ore mine locomotive. Enclosed cab offers weather protection for motorman on outside portion of haul and protection from roof falls on inside.



Six-ton Jeffrey ore mine locomotive. Rounded, welded end frames and smooth side frames with no projecting parts are desirable safety features.

Protection against "down time" and accidents to personnel are just two of the ways Jeffrey power-packed trolley locomotives benefit metal mine operations. For example, electrical equipment is fully shielded from water dripping from the roof or splashing up from the track. Gable-type covers with center channel provide drainage. Rounded end frames, the same height as side frames, protect motorman and trip rider.

Features like these can be built into any of Jeffrey's complete line of four-wheel metal mine locomotives in 4, 6, 8, 11, 15 and 20-ton sizes, and the eight-wheel 27-ton unit. The line spans the narrow gauge field—24", 30" and 36".

Jeffrey trolley locomotives are sturdy, streamlined, easy to operate and repair. Throughout the mining world they haul high tonnage at low cost and are well known for reliability and long-term service.

THE JEFFREY MANUFACTURING COMPANY
Columbus 16, Ohio

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT • TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

These are terms that JKS engineers are concerned with 24 hours a day in the design and manufacture of Diamond Drill Bits that suit your coring and drilling qualifications to a "T".

Throughout years of steady progress these standards were the basis for the drilling bits that are now recognized as unbeatable the world over.

HARDHED matrix for non-abrasive formations
HARDHED 40 matrix for average drilling conditions
HARDHED 55 matrix for extremely abrasive formations

When you next need a diamond drill bit which no formation will slow up, gives full core recovery, faster penetration *AND* saves you *days* and *dollars* in coring and drilling, contact your nearest J. K. Smit field representative or write us direct for literature and assistance.

J. K. SMIT & SONS, INC.
HOME OFFICE AND PLANT
MURRAY HILL NEW JERSEY

British Columbia *(Continued)*

ing engineer, was named president of the organization for 1956; J. A. Pike, Newmont Mining Corp. of Canada, Ltd. and Ulric S. Annett, of Canadian Industries (1954) Ltd. were named vice presidents; and fifteen committee members were chosen.

New members of the executive committee include retiring president S. J. Crocker, B. C. Equipment Co. Ltd.; Andrew Baird, Dawson (Y.T.) Chamber of Mines; Gordon Lee, Whitehorse (Y.T.) Board of Trade; and H. E. Doelle, Chamber of Mines of eastern B. C. and representative of the Vancouver City Council.

Cowichan Copper Co. Ltd. is planning construction of a mill within 18 months, O. G. MacDonald, president, told shareholders.

Mill capacity has not yet been determined but a minimum rating would be 500 tpd on present ore development, MacDonald said.

"However, if the largest anomaly proves up we would erect nothing less than a 6,000-tpd capacity mill or concentrator," he said.

Anomaly referred to is No. 3 crosscut west on the 1200-ft level which has been extended from 508 to 1260 ft. At this point MacDonald believes the development will enter the area in which the large anomaly should be found.

Present development has been on the 1290-ft level in which it is expected to disclose more than 560 ft of ore.

Since Sept. 1, four barge loads of development ore have been shipped to the Tacoma smelter. Total yield from this ore (3,775 tons) is approximately $100,000.

NOVA SCOTIA

With over 80% of Canada's gypsum output coming from Nova Scotia, the province received a substantial boost in production when National Gypsum Ltd. started production at its 5,000 tpd Milford deposit. Production of gypsum in Canada during 1955 may exceed 4-million tons.

SASKATCHEWAN

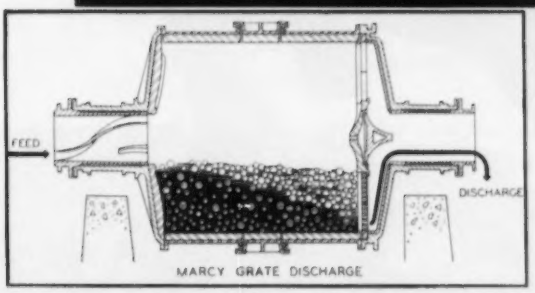
Gunnar Mines, estimated to contain $160-million worth of uranium, started shipping from its 1750-ton mill in 1955. Some annual information is available: 11 mining companies are said to be drilling potash claims in the province. Freezing sinking technique is being employed by two companies engaged in shaft sinking on their potash deposits.

Soaring price of copper is bringing new life and interesting new developments in northern Saskatchewan, specifically in Lac La Ronge area of the Churchill mining division.

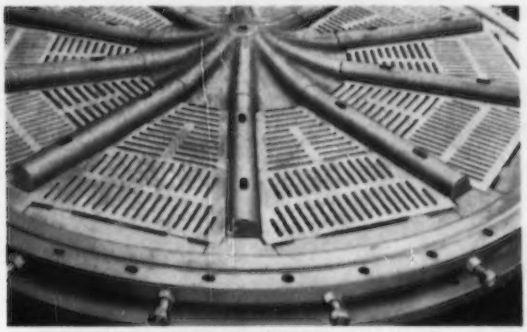
The knowledge that there are substantial copper-bearing sulphide deposits in

how MARCY EXPERIENCE

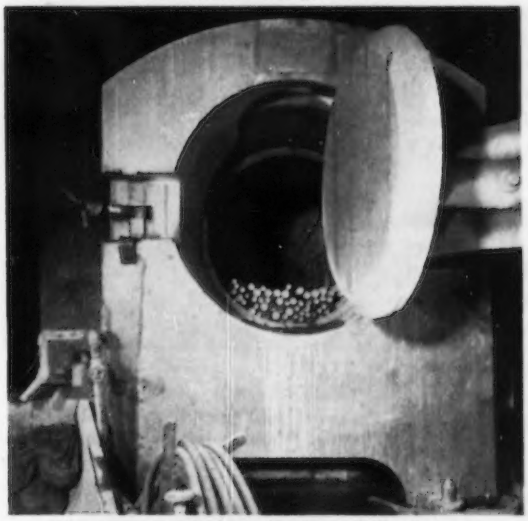
increases grinding mill output up to 50%



Marcy Low-Pulp-Line Grinding, with Grate Discharge.



Marcy Discharge Grates with End and Side Clamp Bars and Center Discharge Liner.



Marcy Open End Discharge Housing, with Plug Door open.

After years of research in the field of grinding Mine and Smelter made the first ball mill, in 1915, incorporating the Marcy principle of grinding..."*rapid change of the mill content is necessary for high efficiency*"

The "rapid change of mill content" is accomplished by maintaining a low pulp line through use of the Marcy full-grate discharge in ball mills and the Marcy open end feature in rod mills.

Early operating *experience* proved the effectiveness of this basic principle in giving greater output at lower KWH per ton than other type mills. Refinements in design and construction, which can come only from *experience*, have continually improved both the mechanical and metallurgical performance of Marcy Mills.

This *experience* by M&S has resulted in production of Marcy Mills which, by actual operating data, have proved their ability to have up to 50% greater capacity than other type mills.

PROVED ADVANTAGES OF MARCY LOW-PULP-LINE GRINDING...

- **eliminates wasteful cushioning action of high pulp level.**
- **provides an active, effective grinding mass to act on particle size reduction only.**
- **there is a faster migration of fines than oversize particles, thus less overgrinding.**

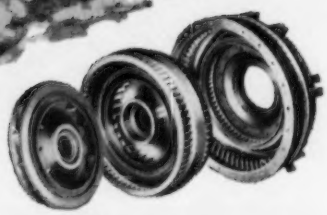
YOU CAN HAVE THE ADVANTAGE OF ALL THIS GRINDING *EXPERIENCE*... JUST WRITE, CALL OR WIRE...

The Mine & Smelter Supply Co.

DENVER • SALT LAKE CITY • EL PASO • NEW YORK

Representatives in Foreign Countries

Twin Disc Torque Converter on shovel increases cable life over 100%!



Records of Zontelli Brothers, of Ironton, Minn., owners of the JoAnn Iron Mine, show replacement of *seven sets* of cable on a shovel equipped with straight mechanical drive—while replacing only *three* sets on one driving through a Twin Disc Torque Converter . . . a substantial reduction in down time, *plus* increased cable life of *over 100%*.

According to Al Fox, Master Mechanic, "considering the cost of down time in replacing cables—plus the cost of cable itself and the actual labor involved in replacing them, the Twin Disc Torque Converter saves us a lot of money."

Both these Model 54-B Bucyrus-Erie 2½-yd. shovels are used to load trucks with iron ore from the open pit mine, where it is then hauled to the washing and crushing plant and processed. One shovel is powered by a diesel engine, with direct mechanical drive—and the other is equipped with a Caterpillar D337 Diesel, working through a Twin Disc Model CF Torque Converter.

In over-all comparisons, the torque converter-equipped shovel increases production, consumes less fuel, and substantially reduces maintenance costs wherever it is used.

For *automatic* matching to load demands, with torque multiplication up to *six times* . . . for cushioning *out* overloads, shock loads and vibrations . . . *specify* Twin Disc Torque Converters for *your* shovels. *Increase* production and cable life—*reduce* fuel and maintenance costs. *Get all the facts.* Write *today* to Twin Disc Clutch Company, Hydraulic Division, Rockford, Illinois. Request Torque Converter Bulletin 135-D.

This Model 54-B Bucyrus-Erie 2½-yd. shovel—powered by Caterpillar D337 Diesel Engine, driving through a Twin Disc Model CF Torque Converter—is loading ore from the JoAnn Iron Mine, owned by Zontelli Brothers, Ironton, Minn.

TWIN DISC

TWIN DISC

Torque Converters

BRANCHES OR SALES ENGINEERING OFFICES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • TULSA

On-the-Job power lubrication - where it's needed, when it's needed!

ALEMITE PORTABLE SERVICE STATIONS

64% faster!

cut maintenance time to the bone!

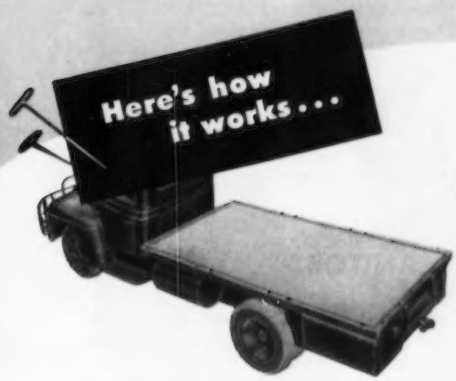
Alemite Portable Service Stations take all the advantages of power lubrication right to machines on the job—no time spent in travel to and from a grease shop—cut maintenance and downtime to the bone. Even more important, they assure the protection only power *lubrication* can give, greatly reduce the chances of costly bearing failure.

And you get all this tailored to your exact lubrication needs—all from standard Alemite equipment. Nothing is specially built. An Alemite Portable Service Station soon pays its own way by proven savings in time, money, equipment! Mail coupon for FREE booklet.

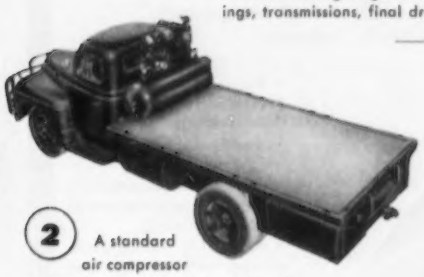
Alemite Portable Service Stations offer these four services

- Fast, easy lubrication of track rolls and fittings.
- Quick filling of gear housings, transmissions, final drives.
- No oil wasted—delivers exact amount of lube required.
- Air line equipment for tire inflating, air cleaning.

Here's how it works...



1 You choose the truck that fits your needs for size, power, terrain.

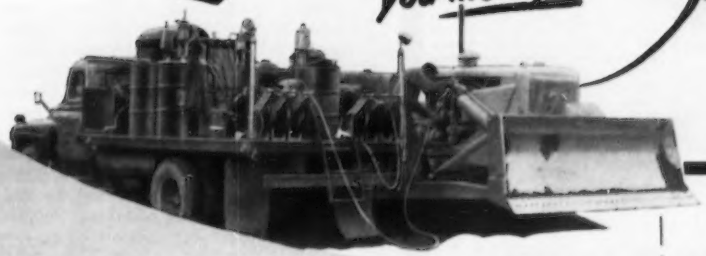


2 A standard air compressor is installed—usually behind the cab.

3 Alemite Barrel Pumps are added to handle pressure gun and gear lubricants, motor oils, you'll use.

4 A bank of Alemite hose reels are added. They reach out in a 40' working radius to service your rigs on the job.

...and your Alemite Portable Service Station is ready to roll... *ready to save you money!*



ALEMITE

REG. U. S. PAT. OFF.

A PRODUCT OF SW STEWART WARNER

ALEMITE, Dept. E-26
1850 Diversey Parkway, Chicago 14, Illinois

Gentlemen: Please send me your FREE illustrated booklet containing complete information on Alemite Portable Service Stations and Alemite equipment.

Name .....

Company .....

Address .....

City ..... State .....

E. A. GODOY & CO., INC.
CUNARD BUILDING, 25 BROADWAY
NEW YORK 4, N. Y.

CHROME ORES · Refractory · Metallurgical · Chemical
MANGANESE ORES · Metallurgical · Chemical
IRON ORES · Open hearth · Blast furnace

TWO NEW EXTRA-SENSITIVE GEIGER COUNTERS by RCA!

MODELS WF-15A and WF-16A . . .
recommended especially for professional prospectors, laboratories, schools, industry.

- Rugged all-weather stainless steel cases easy-to-decontaminate
- Compact, portable, lightweight
- Connectors for attaching probes with extension cables up to 2000 ft. long
- Powered by readily available portable radio batteries
- Built-in battery voltage checkers
- Can be used for AIRBORNE and CARBORNE radiation surveys
- Meter controls for "fast" or "slow" meter readings
- Controls to compensate for background radiation
- Meter zero-reset buttons

Both models supplied complete with all tubes, batteries, headphone, top-grain leather carrying case and shoulder strap, radioactive test sample, AEC booklet—"*Prospecting With A Counter*"—and operating instructions.

RCA Geiger Counters are manufactured with top-grade components and superior workmanship. They are designed to withstand the tough requirements of professional prospectors. RCA Geiger Counters assure dependable performance even under severe operating conditions—desert heat, high humidity, and mountain altitudes. SEE YOUR RCA DEALER FOR A DEMONSTRATION. For literature, write RCA, Commercial Engineering, Sec. B-66-MM, Harrison, N. J.

†List Prices (Optional)

MODEL WF-15A...$475.00†
- 3 counting ranges: 0-1,000; 0-10,000; 0-100,000 Counts per Minute (CPM)
- Uses a bank of ten 1B85 Geiger-counter tubes
- Useful in aerial surveys up to 1000 ft.
- Indicates radiation to 500 ft. each side in carborne surveys.

MODEL WF-16A...$750.00†
- 3 counting ranges: 0-2000; 0-20,000; 0-200,000 (CPM)
- Uses ten extra-sensitive 6306 bismuth-type Geiger-counter tubes inside case
- Useful up 1000 ft. in aerial surveys
- Indicates radiation to 1000 ft. each side in carborne surveys.

Note: Four popular-priced models are available—$119.50-$186.00.†

RADIO CORPORATION OF AMERICA
Radiation Detection Equipment — *Harrison, N. J.*

Saskatchewan (*Continued*)

the La Ronge area, 90 miles north by highway of Prince Albert, has existed for more than 35 years.

Prospecting actually got underway in 1920 on a substantial scale and by 1929 several significant finds had been made.

In those days, however, road access was non-existent. Even today, with all-weather tourist and passable development roads, the big barrier to development of deposits is transportation. Nearest railhead is 75 miles distant.

In the last six months La Ronge area in particular has experienced a major staking rush, with interest centered mainly in the known copper zones. The number of claims staked from Oct. 1 to Dec. 1 has been unofficially estimated as exceeding 2,000.

Most important fillip for the claim stakers was the purchase by Glenn Uranium Co. of 50 claims near Keg Lake. For these claims the company paid the impressive figure of $500,000. Drilling has begun on this property and already shows that copper values increase with depth.

A second property attracting wide attention is at Waden Bay, where Anglo-Rouyn Mine and Exploration Co. states its drilling operations have indicated 3-million tons copper-cobalt-gold ore.

MANITOBA

Manitoba's mineral industry will establish a new record for value of production during 1955. Total value of all mineral production is estimated to be approximately $62.9-million, compared with $35,106,922 in 1954. This increase can be attributed mainly to the metals and crude oil production. Metal production is estimated at $41-million compared with $19,745,612 in 1954, while value of crude oil increased from $5,619,649 to an estimated $9.8-million.

Sherritt Gordon Mines Limited has increased nickel production to a rate in excess of 20-million lb per year. Net return from sale of products for the first nine months of 1955 totalled $15,462,333. At Lynn Lake, the Company has been carrying out diamond drilling on two new orebodies as well as conducting exploratory work in the Moak Lake and Fox River areas of the province.

Lithium Corporation of Canada (controlled by Mogul Mining Corp.) is planning to bring its Irgon Lithium property into production on a 500 tpd basis. A three compartment shaft is to be carried to 500 ft. Arrangements have been made to complete the Bird River road into the property and construct a 15-mile power line. An estimated 790,000 tons grading 1.4% lithia has been outlined by diamond drilling with an additional 200,000 tons of probable ore indicated.

International Nickel Co. has completed a shaft to the 1300-ft level on its Moak Lake property. Levels have been established at 700 and 1300 ft. Some 10,000

THE STRONGEST WIRE MAKES THE STRONGEST ROPE... THAT'S WHY ONLY 1105 IS USED IN

ROEBLING

Royal Blue

WIRE 1105 ROPE

1105 WIRE is the strongest and toughest rope wire that has ever been developed.

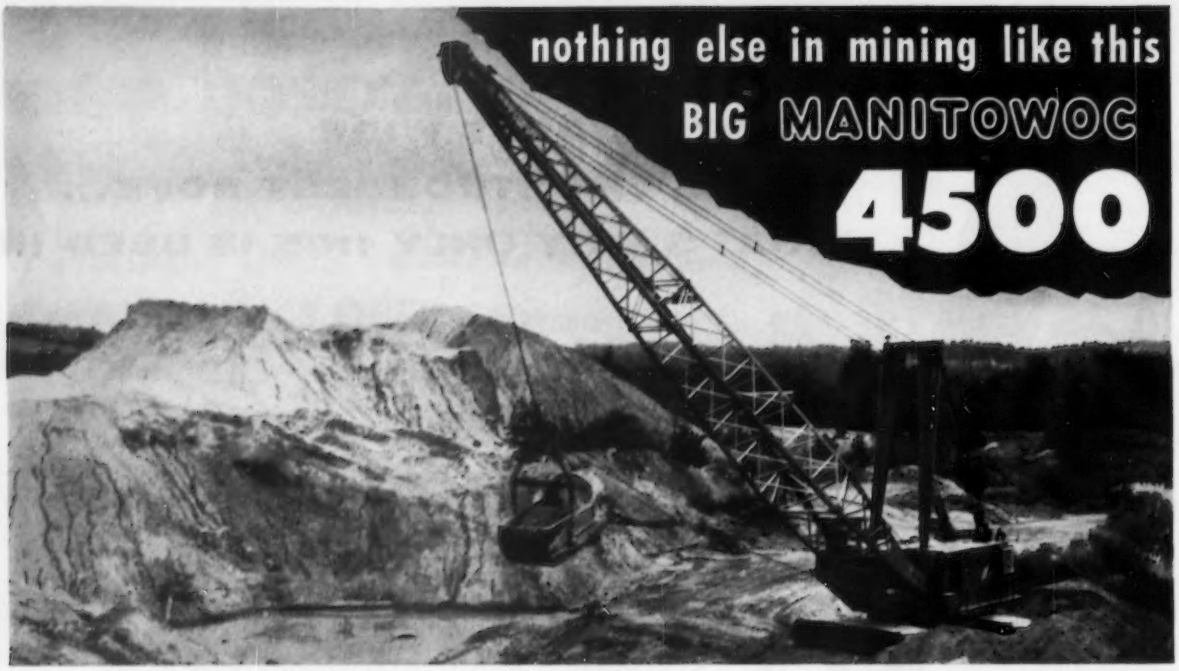
Royal Blue is a new all-steel wire rope. It's made of 1105 wire—stands up in service—gives you more for your money because it has more to give.

Ask us for the full facts about Royal Blue Wire Rope, or contact your Roebling distributor.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST. AVE. S. • TULSA, 321 N. CHEYENNE ST.• EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.



Little downtime with great capacity is the record set by this 4500 dragline mining limonite ore for U. S. Pipe and Foundry Company near Russellville, Ala.

There's no place for undersized, underpowered mining machines when you're aiming for more production per man hour. That's why the husky Manitowoc 4500 is today's "greater output" champ among mining operators.

United States Pipe and Foundry Company of Birmingham, Ala., use two 4500 draglines equipped with 140′ booms and 4 yd. buckets for mining limonite ore. Satisfactory performance from three Manitowoc 2-yd. shovels led to their choice of the larger 4500 machines. Top capacity with little downtime for all five units, is due to Manitowoc's simple design and superior construction.

TOP DESIGN FEATURES MAKE A TRUE MINING MACHINE

GREATER SIMPLICITY OF DESIGN directs more power to the dipper or bucket. Only four main shafts — only 15 gears — only working gears turn.

GAS OR DIESEL UNIT DRIVE effectively utilizes power — eliminates thousands of electrical wires and components. Full power can be applied to any operating function with less dead weight than is found in electric machines. Greater mobility — no restrictive electrical cables.

EXCEPTIONAL STABILITY assures top capacity. Massive carbody, adequate counterweight and long, wide crawlers let you reach way out with full safety and low ground bearing pressures.

SPECIAL HI-LIFT SHOVEL BOOMS available in two lengths — 60′ boom with 45′ tubular stick and 50′ boom with 37′ stick.

POWER-SMOOTH TORQUE CONVERTER, pioneered in power shovel application by Manitowoc, multiplies engine torque three times. Efficiency is increased and engine life extended. With engine power balanced to the load, engine **cannot stall — cannot be overloaded.** Make the Manitowoc 4500 your next mining machine. Send today for your free copy of the new 20 page Model 4500 illustrated catalog — no obligation!

Air-operated controls and clear, unobstructed view from large comfortable cab help 4500 operator do a better job.

MANITOWOC
SHOVELS 1-5½ YD. Speed Crane CRANES 20-100 TON

MANITOWOC ENGINEERING CORP.
Manitowoc, Wis.

A Balanced Program for Improved Drilling

TEE CEE
(tungsten carbide insert bit)

LIDDICOAT
(used to destruction — no resharpening bit)

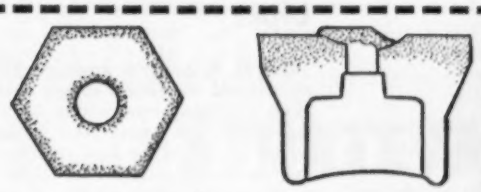
Carburized Drill Rod

To equal the fine drilling quality of Liddicoat bits, a drill rod has been developed to provide much greater footage and consequently lower cost per foot of hole drilled. The drill steel has been carburized to provide a stiff rod with a hardened section on the outside of the steel, and on the inside around the water hole. These hardened sections are supported by a strong ductile core.

Carburizing treatment has been designed to correct weaknesses existing in ordinary steel; namely, surface decarburization and low strength zones. By carburizing and hardening, tendency to fatigue failures, rapid wear in drill rods is lessened. The carburized rod incorporates mechanical and metallurgical refinements heretofore unavailable in drill steel.

⅞" Hexagon is the most popular section for feed-leg drilling. To secure the advantages of this cross section of drill steel, the Liddicoat bit is made in type 3 TEE CEE, 3-L and 3-H — all have the same socket size. Within the socket are forged six flats to match the flats on the rod. The bits are all interchangeable, which provides a type of bit best suited to ground conditions.

A trial order will prove the merit of this balanced combination to your entire satisfaction.



Dots in sketches indicate the hardened portions of cross section of drill rod and hardness pattern of Liddicoat bit.

WESTERN
Rock Bit Manufacturing Company
552 West 7th South • Salt Lake City 4, Utah

FLEXIBLE, 2-BEARING IDLER

cuts belt conveyor maintenance 90%

Still on the go after 2½ "no-downtime" years handling abrasive foundry sand, with a 90% reduction in idler maintenance—that is the record of a unique belt conveyor idler, the Joy *Limberoller.*

Other installations include successful handling of sticky, corrosive triple super-phosphate and fertilizers, potash, wet concrete mix, hot coke, coal, sticky iron ores, trap rock, with up to *eleven times* the service life of former idlers on the same jobs.

Resilient discs on a flexible steel cable, the Joy *Limberoller* has only 2 bearings, up out of the dirt. It conforms to the load, cushions and guides belt; needs no lubrication. It resists dust, abrasion, corrosion and material buildup—thus avoids fouled bearings; minimizes chemical and mechanical wear.

The *Limberoller* weighs ⅔ less than a conventional steel idler; is locked by a simple cotter key into special lightweight stands for easy installation and removal. No cover sheets are needed. Two types of stands are available: one that bolts to conventional rigid sections; and a self-supporting type that forms its own easily-erected portable sections without bolts, by using special stiffening rails.

Because of these unique features, many companies have adopted *Limberollers* as standard for all belt conveyor operations. *Limberollers* are available for belt widths of 18" —42". Details from ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ont.* Bulletin 61-4.

Manitoba *(Continued)*

ft of lateral work is planned to provide stations for a detailed program of diamond drilling. Company has staked out a 25-mile belt of ground along the Fox River where anomalies appear similar to those at Mystery and Moak Lake. Investigation of the Fox River belt will continue throughout the coming year.

Low-grade iron ore deposits at Bruce Lake, 180 miles northeast of Winnipeg, will be exploited by the Iron Bay Mines Co. Ltd., Toronto, which will build a processing plant on the mining site. The cost of the project is estimated at $50-million.

The final decision on opening up the mines was reached after the return from West Germany of the company's geologist, Dr. M. W. Bartley. Dr. Bartley had the taconite deposits from Bruce Lake tested in laboratories at Frankfurt, and had the costing of the mining and processing operation checked by German experts.

Initial production of pellets having a consistent 65% iron content is expected to be half a million tons a year, rising to an estimated 2-million tons a year. The mining site has proven deposits of 200-million tons of ore.

YUKON TERRITORIES

Metal mining production in 1955 reached $16-million in the Yukon Territory, while Northwest Territories recorded $10.5-million, in addition to Great Bear Lake uranium production. A record number of prospectors, miners and mining companies are prying open the earth's crust in the search for mineral wealth in the Territories, said Thomas Elliott, manager, British Columbia and Yukon Chamber of Mines.

Production from Cassair Asbestos is at 1,000 tpd ore and mine output last year was valued at $4.7-million. This deposit is one of the world's richest.

United Keno Hill mines produced lead, silver and nickel valued at $1,697,000 during 1955.

Interesting deposits of uranium were discovered in the Territories during this past year.

IN LATIN AMERICA

ARGENTINA

Unexpected and sudden relief came to the mining trade in December, when the government announced that henceforth ores and minerals could be sold overseas at the free rate. At current dollar value, peso-wise, the measure doubles the intake, and thus U. S. purchasers of ores cannot only expect a substantial future rise in Argentine shipments but will also see the shippers anxious to deliver better quality under a new spirit of cooperation. Local miners' year-long difficulties can now be largely solved, and many of the dollars thus received are expected to go to U. S. manufacturers of mining equipment and machinery, observers say.

The shift in the exchange rate will also cause a change of officially established prices on such ores as tungsten, mica, lead and berrylium, the purchase of which so far is a government monopoly. Explains Argentina's new Minister of Commerce, Dr. Juan Llamazares: "Even though the government agency, IAPI, buyer and seller of these ores, is destined to be dissolved, the government will not give up purchasing them. However, in line with its policy to liberalize prices and untie controls, eventually it is better for the state to cease with its monopoly over purchases. Meanwhile, we will have to establish a guaranteed minimum to compensate the producers."

BOLIVIA

Bolivian Minister of Mines has given to a group of Bolivian mining technicians and specialists, and also to the United Nations technical adviser, copies of special reports and studies made for the proposed construction of a tin smelter plant, along with those produced by Germany's Krupp and Lurgi, for their recommendations.

U. S. firm will exploit gold fields at Beni. (Another contract of exploitation was signed with the "Souther Heater Corp." of Compton, Calif., 6 months ago.)

This time, Bolivian Exploration and Development Co., Washington, D. C., incorporated in Delaware, will exploit 37,000 acres of gold fields at the northeast area by dredges under a royalty contract signed with Bolivian government.

BRITISH GUIANA

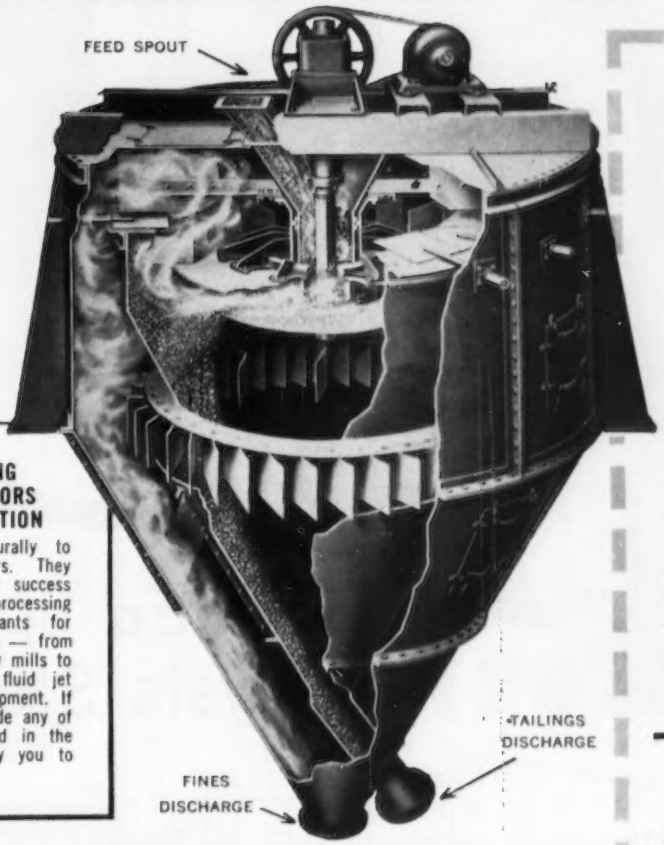
Record production was achieved at the world's largest bauxite operation during 1955; 2.2-million tons were shipped to Quebec smelter of Aluminum Co. of Canada. Stockpiling will continue all this coming winter, until the ice breaks up in Canada's Saguenay District. With depth of overburden on the increase, mining has switched from tractor scraper to dragline methods.

CHILE

Three U. S. concerns produced 95% of the 420,000 ton record copper output in 1955. Total copper production was 60,000 tons over 1954 figure. New production record was set in the face of strikes that cost the copper market over 32,000 tons in December alone. With a gradual planned expansion, output may reach 450,000 tons next year, barring labor troubles.

Remolinos mining camp near the town of

40 TO 400 MESH OUTPUT UPPED AS MUCH AS 300%



ENGINEERING AIR SEPARATORS TO SPECIFICATION

. . . comes naturally to Sturtevant engineers. They have a tradition of success in developing dry-processing equipment and plants for more than 75 years — from the first rock emery mills to the most modern fluid jet micron-grinding equipment. If your problems include any of the processes listed in the coupon, it will pay you to investigate.

WHAT CAN A STURTEVANT AIR SEPARATOR DO IN YOUR PULVERIZING SYSTEM?

In the cement industry, Sturtevant Air Separators have a tested record of increasing mill capacities from 25 to 300% while lowering power consumption as much as 50% — when used in closed circuit with grinding mills. Maybe they can do as well for you.

Easily adaptable to your materials. Sizes of Sturtevant Air Separators range from 3 to 18 feet in diameter. They deliver fines from 40 to 400 mesh at rates as high as 100 tons per hour.

Designed to cut costs! Sturtevant Air Separators are built for a lifetime of low-downtime service. Rugged construction plus easy accessibility for quick maintenance (typified by the "OPEN-DOOR" design in other Sturtevant equipment) assures more output per machine-year. Check the coupon for more information.

STURTEVANT

Dry Processing Equipment

The "OPEN-DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS

STURTEVANT MILL COMPANY, 101 Clayton Street, Boston 22, Mass.

Please send me your bulletin on Air Separators ☐
Also bulletins on machines for:

☐ CRUSHING ☐ GRINDING ☐ PULVERIZING
☐ MICRON-GRINDING ☐ SEPARATING ☐ BLENDING
☐ SUPERFINE SELECTING ☐ GRANULATING ☐ CONVEYING

My dry-process materials are:_____

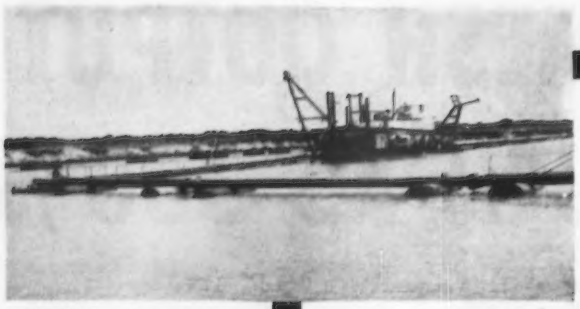
Desired capacity is:_____

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____



DREDGING a channel with Armco Pipe

COAL handled hydraulically with Armco Pipe

PHOSPHATE mining operations with Armco Pipe

For longer pipe life in hydraulic material handling—specify

ARMCO Special Analysis Steel Pipe

SIZE DATA

DIAMETERS are from 6 to 36 inches.
WALL THICKNESSES are from ¼-to ½-inch.
LENGTHS up to 50 feet.
CHECK THESE FEATURES: Smooth interior, free from laps or other obstructions, provides high flow capacity; hydrostatic testing assures ample strength for high pumping pressures; wide range of diameters and wall thicknesses avoids compromise with exact job requirements; pipe ends can be supplied machine reduced or expanded, with flanges or standard coupling, or for welding.

For more than 35 years, Armco has been producing pipe for hydraulic material handling. The Armco Special Analysis Steel Pipe of today is the culmination of these years of research and practical field experience.

Armco Special Analysis Pipe has ample strength and ductility, combined with high abrasion resistance to provide long service life and hold down costs.

For more details in terms of your own requirements, write us. Also ask about Armco Steel Pipe for water supply lines and similar needs. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 3636 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

Armco Special Analysis Steel Pipe

ARMCO®

Cut Downtime Losses by Having Tires Repaired or Retreaded While Your Equipment Is Idle

SECTION REPAIRS — Can be handled on any tire with Firestone's repair facilities.

FIRESTONE RETREADS — A special cut-resistant tread rubber compound is added. Scientifically controlled pressure is applied to eliminate air pockets and to give maximum adhesion.

GET GOOD, FAST SERVICE AT Firestone

YOU'RE time and money ahead when you let Firestone handle your repair and retreading needs.

You cut your tire maintenance costs because Firestone is equipped to do the job better, quicker and at lower cost.

You save with Firestone Traction Cap retreads or Firestone Full Cap retreads because they stand up longer and keep your downtime at a minimum. Firestone Retreads have the proved Firestone new tire tread design for greater traction, greater driver control, more hours of service.

Call your Firestone Dealer or Store for faster service on all your repair and retreading needs.

TRACTION CAPS OR FULL CAPS AVAILABLE FOR THE FOLLOWING TIRE SIZES

8.25-20	18.00-24
9.00-20	18.00-25
10.00-20	21.00-24
11.00-20	21.00-25
12.00-24	24.00-25
13.00-24	24.00-29
14.00-20	24.00-32
14.00-24	27.00-33
14.00-25	29.5 x 25
16.00-24	30.00-33
16.00-25	

GROUND GRIP FULL CAP | **ALL NON-SKID FULL CAP** | **ROCK GRIP FULL CAP**

Enjoy the Voice of Firestone on radio or television every Monday evening over ABC

Copyright 1955, The Firestone Tire & Rubber Co.

Chile *(Continued)*

Copiapó, Atacama province, is delivering increasing tonnages of good grade milling copper ore to the Punta del Cobre plant, one of the Mining Credit Bank mills that supply the Paipote smelter with needed copper concentrates. Chief producer in this camp is Señor Ramón Osorio, a well known copper and gold miner.

Mining Credit Bank has decided to go ahead with the necessary test work previous to building at its Salado mill a 100 tpd slime plant to handle 3 to 4% oxide copper ore from abundant dumps and fillings existing near this mill. El Salado plant is located 20 miles inland from the port of Chañaral, which is also Andes Copper Mining Co. port. El Salado already has a 200 tpd copper flotation mill and a 50 tpd gold cyanide mill.

Mauricio Hochschild interests, after drilling the Mantos Blancos copper property 40 miles to the east of Antofagasta has decided to build a pilot plant to test the best way to leach oxide copper ores whose chief mineral is atacamite. So far, no sulphide ores have been found.

Compañía Salitrera de Tarapacá is pushing drilling and development of the Cerro Imán high grade iron deposit west of Copiapó. Tarapacá anticipates mining 20,000 tons of iron ore.

Societé des Mines de Charriere has acquired control of Cie. Miniere du M'Zaita, owner of the El Soldado, and Cerrado mines and mills in Central Chile with 600 and 150 tpd capacity respectively. Charriere will also control Cia. Minera Disputada de Las Condes, a Chilean company with a 700 tpd mill 40 miles due east from Santiago which has been controlled for many years by M'Zaita. Charriere has also taken an option on the Manto Verde and other copper mines owned for many years by Societé des Mines de Cuivre de Chañaral, 10 miles due south from El Salado mill, a depot on the railroad from Chañaral to Potrerillos mine.

Manto Verde has a large tonnage of low grade oxide copper ore and the company that owns the option proposes to build a 500 tpd mill to beneficiate the ores. Leaching will be done with SO_2 gas in a brine solution. Water saturated with sodium chloride (145 gram per liter) is plentiful in El Salado river, which takes its name from the fact. Before constructing the large mill, a pilot plant will be built near El Salado for tests. Charriere owns tungsten mines in France and in some of the French colonies in northern Africa.

COLOMBIA

Mining output for 1955 equaled $72.8-million (182-million pesos) according to Colombia's Ministry of Mines and Petroleum, an increase of about $16-million over 1954. Interest in radioactive minerals has increased, and laboratory analysis equipment has been ordered by the government.

Find of 45-50% iron ore has been made less than 20 miles from the village Paz de Río, which is 10 miles north of the steel mill of Acerías Paz del Río.

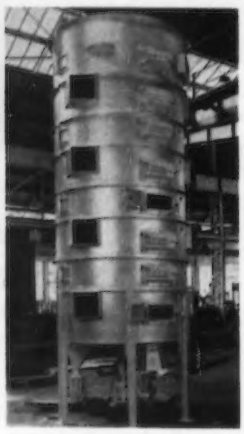
Deposits on which the steel mill is

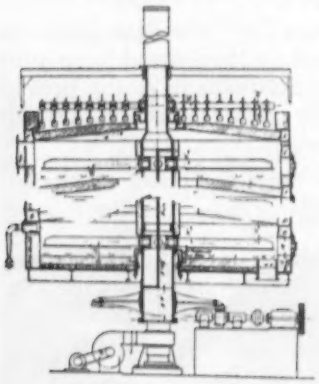
SKINNER
Multiple Hearth Roasters and Dryers

Proved in the Field for 37 Years...
...on many applications

Skinner Roasters, manufactured by Colorado Iron Works, have been used for efficient roasting and drying of ores, clays, limestone, lime-sludge; decomposing oil sludge in the process of recovering sulphuric acid. These applications include sulphide roasting; oxidizing, reducing and chloridizing roasts.

Skinner Roasters have been used from the beginning in the Uranium-Vanadium industry. In the case of asphaltic ores the roasters burn off the undesirable carbon. On non-asphaltic ores roasting facilitates extraction and has become standard practice for removal of the vanadium content through salt-roasting.





MECHANICAL FEATURES

Skinner Roasters consist of a series of superimposed hearths over which the material is rabbled by rotating arms and easily replaceable teeth. The rabble arms are fastened to the central shaft by means of the distinctive Skinner bayonet lock. The shaft is constructed to allow for ample cooling of both shaft and arms from a blower or by natural draft. Among the distinctive advantages of CIW Skinner Roasters are: small diameter rugged center shaft increases net hearth area and volume; simple vertical adjustment of central shaft; quick replacement of rabble arms and teeth without cooling; up or down-draft and multiple hearth gas off-takes permit wide range of control; negligible dust losses. Coal, oil or gas fired. Sizes 2 to 12 hearths; 4'-0" to 23'-6" inside diameter.

CIW COLORADO IRON WORKS CO.

COLORADO IRON WORKS CO.
1624 17th Street • Denver 2, Colorado
AKINS CLASSIFIERS • SKINNER ROASTERS • LOWDEN DRYERS
Sales Agents and Licensed Manufacturers in Foreign Countries
A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.

ORE TESTING

ACCURATE AND COMPLETE DATA FOR THE PROPER DESIGN OF ORE TREATMENT PLANTS IS BEST OBTAINED THROUGH CAREFUL LABORATORY TESTING BY ENGINEERS OF EXPERIENCE. OUR 40 YEARS SERVICE IN THIS WORK IS AVAILABLE TO YOU AND INCLUDES—

FLOTATION, ALL TYPES
COPPER ORE LEACHING
URANIUM ORE LEACHING
RARE MINERALS
CYANIDATION
THICKENING—FILTERING

USE THIS SERVICE FOR NEW PLANTS OR FOR EXISTING PLANTS

the **BOOTH** company, inc.
333 WEST 14TH. SOUTH ST.
SALT LAKE CITY 15, UTAH
MINERALS SEPARATION MANUFACTURE—EQUIPMENT

BUILT FOR ROCK-HARD ROAD WORK

The Allis-Chalmers HD-21 is a Real Miner's Tractor

Chiseling an access road through rock demands "something extra" in crawler tractor performance and durability, yet it's the kind of job any miner's tractor may be required to do.

Conditions like this call for an Allis-Chalmers HD-21. Its 204-hp Allis-Chalmers engine is noted for its ability to perform with a minimum loss of efficiency even after thousands of hours of operation. Torque converter drive multiplies torque up to 4½ times . . . develops 41,500 lb drawbar pull at low speeds . . . cushions the entire power train against load shocks.

New Tru-Dimension tracks bring a new high in track durability. Thousand-hour lubrication intervals save maintenance time. Positive seals protect idler, support roller and truck wheel bearings from abrasive wear as no other seals can.

Ask your Allis-Chalmers dealer to show you the many other features that make the HD-21 a natural for rock-hard assignments.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

Mixer Blade Life Increased 19 Times

by **Hard-Facing**

Blades hard-faced with HAYSTELLITE tungsten carbide rod have been in operation for 20 months—and are still in good condition. They have mixed 36,000 cubic yards of concrete while operating 3 shifts a day, 6 days a week. Unprotected cast steel blades had to be replaced every 4 to 5 weeks while operating under the same conditions. More than 19 shutdowns have been eliminated by hard-facing, and repair and replacement costs have been cut sharply.

Big savings like this are not unusual when HAYNES hard-facing products are used to prolong the life of equipment. These wear-resistant materials give outstanding service when used to protect conveyor screws, buckets, crushers, tractors, and other equipment exposed to abrasion, corrosion, impact, or heat.

Your local dealer carries a complete line of HAYNES hard-facing alloys, including HAYNES iron and nickel-base rods, HAYNES STELLITE cobalt base rods, and HAYSTELLITE tungsten carbide tube rod. Ask him for descriptive literature. If you don't know the location of your local dealer, write to Haynes Stellite Company, a Division of Union Carbide and Carbon Corporation, Kokomo, Indiana.

See... | **Your local Haynes Stellite Dealer**

or

Write... | **to Haynes Stellite Company**

"Haynes," "Haynes Stellite," and "Haystellite" are registered trade-marks of Union Carbide and Carbon Corporation.

Break it up to bite size...with APEX®

VERSATILE APEX explosives are an important factor in the amazing improvements in breakage now possible with the newest Atlas development . . . Alternate ROCKMASTER® combined with Alternate Velocity Loading.

Apex is an economical ammonium nitrate explosive with a patented assembly having a water-proof gelatin core that offers these advantages:

- **The water-proof core promotes complete detonation of the explosive in wet holes.**
- **Complete propagation of the column in any height face.**
- **Fluted-end cartridge permits easy loading.**
- **A wide range of strengths and velocities to choose from. Apex is available in 8 strengths: each in low, medium and high velocity.**

For maximum breakage, better control of throw and economical production, team APEX explosives with the ROCKMASTER Blasting System.

For complete information on all Atlas Explosives Products, ask your Atlas representative for a copy of the new Atlas Explosives Catalog.

ATLAS

ATLAS EXPLOSIVES

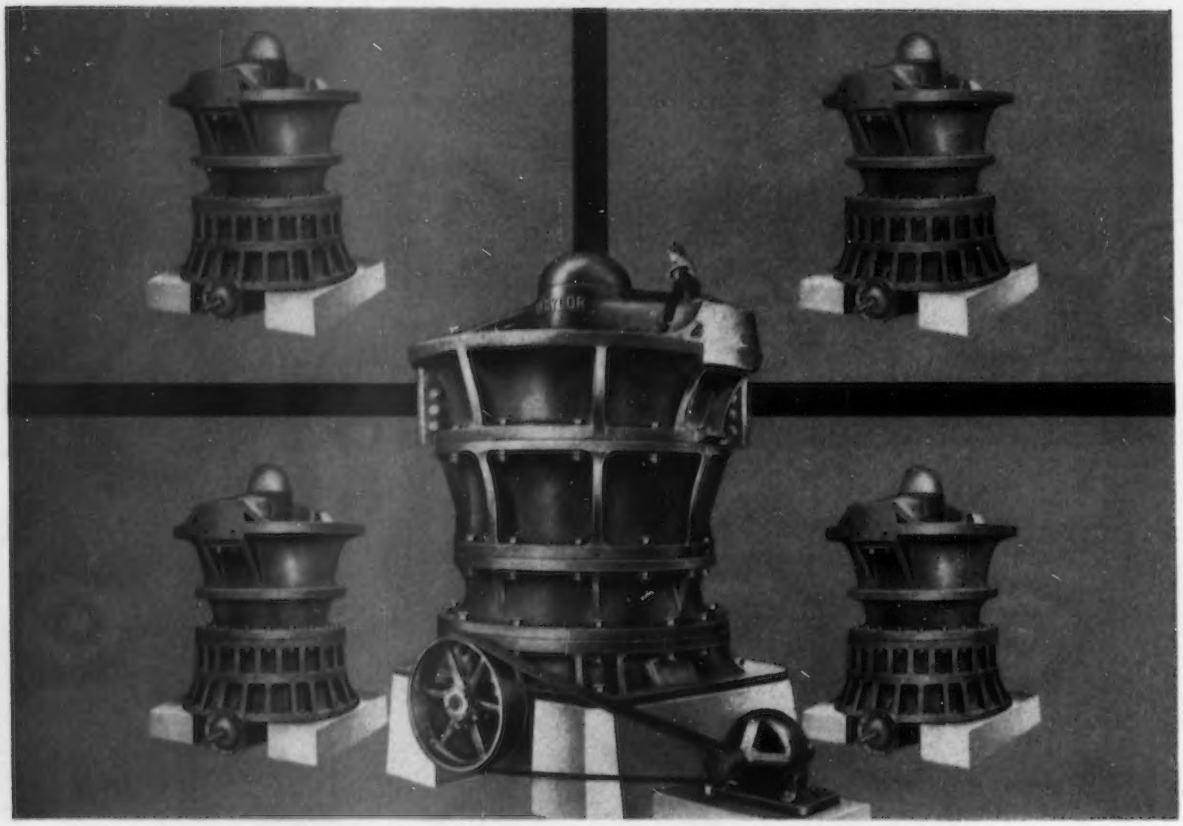
"Everything for Blasting"

ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE

Offices in principal cities

TRAYLOR TC GYRATORY CRUSHERS

Promise Profits In Production of Taconite Ore at Aurora



TRAYLOR IS NOW BUILDING

5 for 1 Customer

Profitable production of iron ore from low-grade taconite calls for the most modern, efficient methods and equipment. That's why one customer alone ordered 5 Traylor TC Gyratory Crushers for the primary and secondary reduction of extremely hard Taconite-bearing rock at the company's Aurora Project.

The giant Primary Crusher, now being built by Traylor, has a 60" receiving opening and 120" diameter crushing head. The seventh of its kind to be built by Traylor, this TC Gyratory weighs more than 1,250,000 pounds and is higher that a three-story house. In a 15 hour day this TC will crush 66,000 long tons of rock. Chunks of ore the size of a flat-top desk, dumped into the crusher at the rate of 4,400 long tons per hour, will be reduced to 12" material. Four 36" Traylor Gyratories will take the 12" ore from the primary crusher and reduce it to minus 5" in the secondary reduction.

For increased production and extra profits . . . follow the example of leaders in the mining industry who have selected Traylor equipment for its known efficiency and dependability.

Traylor Bulletin #126 contains complete specifications and description of the outstanding features of Traylor TC Gyratory Crushers . . . send for your Free Copy today.

TRAYLOR ENGINEERING & MFG. CO.
831 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfr: Canadian Vickers, Ltd., Montreal, P.Q.

A Traylor leads to greater profits

Colombia *(Continued)*

based are calculated to last 18 years at the rate of exploitation of 3,500 tpd which already contemplates a trebling of the output of the steel mill.

New deposits of as good iron ore, 45-50% Fe and 7-15% SiO_2 cover an area of a least 25 square km (6,000 acres) with an average thickness of 3 to 4 ft, about 10 ft under the surface.

Discovery alone will extend the supply of iron ore for the steel mill to about 50 years and geologists suspect more very substantial deposits in the area.

Servicio Geológico Nacional is making a detailed study by aerial survey and ground check-ups and hopes to be able to give a more complete picture in about six months.

MEXICO

Mineral production figures for the first 9 months have been issued by the Secretariat of National Economy as follows: gold 32,089 troy oz, silver 4.04-million troy oz, copper 4,548 metric tons, lead 17,854 metric tons, and zinc 22,704 metric tons.

Cia. Metalurgica Peñoles, S. A., subsidiary of American Metals Co., last month at its smelter at Torreon, Coahuila, began receiving shipments by rail of lead concentrates from Cia. Minera Huehuetenango, S. A., of Guatemala. Oxide lead concentrates are expected to be received at the rate of 1,200 tpm.

Cia. Minera Victoria Eugenia, S. A., in which the firm of Vaupell y Garcia owns controlling stock, this month expected to begin producing lead and zinc concentrates at its new 300 tpd capacity flotation mill near Chalchihuites, Zacatecas.

Ing. Jose A. Garcia said that in all about six small mines are involved. Ore-in-sight, galena and zinc sulphides, is estimated at about a half-million tons and further exploration work is being done. The mines were worked centuries ago by the Spanish. Initial mill operations were planned for 125 tpd, with the 300 tpd capacity to be reached slowly. Mines superintendent is Ing. Felipe Dorado Nuñez.

HAITI

Island's untouched mineral resources are getting considerable attention from U. S. and Canadian interests. Halliwell Consolidated Ltd. is reported to have found a commercial grade copper deposit on the island. Kaiser Aluminum is prospecting for bauxite, while Reynolds Aluminum is starting up a large bauxite operation at Miragoane.

young man in a hurry!

He's keeping up with one of Fairchild's fast-flying airborne magnetometer planes to make *this morning's records available tonight* for our client's easy interpretation.

The original airborne magnetic records come out of the recorder on an "inches-per-minute" basis, which can never be made to equal inches-per-mile, especially when our airplane flies against the wind on one flight line, and with the wind on the next line. This makes alternate magnetic profile tapes of different lengths (as well as reversed), and the records have different horizontal scales. Because of this, critical measurements on individual magnetic anomalies are hard to make, and magnetic trends are sometimes hard to visualize.

With this variable speed plotter, which we call our "stacker," we redraw the profiles to any desired horizontal and vertical scales, and put them in their proper position, one above the other, for rapid and sound interpretation. One of the original magnetic records is on the small drum to the left, the sheet of stacked profiles on the large drum. Magnetic trends thus become immediately visible, and the anomalies can be carefully measured.

These "stacked profiles" aren't quite as precise or valuable as the final Fairchild magnetic contour map, but several of our clients demand them because of their quick availability and convenience—particularly when the client is in the field with our flight crew, and wants to be able to take immediate action on the magnetic results.

Our stacked profiles will beat the preliminary contour map by at least a month, maybe more on a big survey.

And so our young man's in a hurry.

This client wants to know that the flying he will order tomorrow is in the proper place, and based on sound geophysical deductions.

It pays to explore with

FAIRCHILD
AERIAL SURVEYS, INC.

Los Angeles, Calif.: 224 East Eleventh Street
Long Island City, N. Y.: 21-21 Forty-First Ave.
New York City, N. Y.: 30 Rockefeller Plaza
Chicago, Ill.: 111 W. Washington Street
Boston, Mass.: New England Survey Service, Inc., 51 Cornhill
Seattle, Wash.: Carl M. Berry, P.O. Box 38, Boeing Field
Vancouver, B. C.: Aero Surveys LTD., International Airport
BOGOTA • CARACAS • LIMA • RIO DE JANEIRO

BRUNTON*
pocket transit

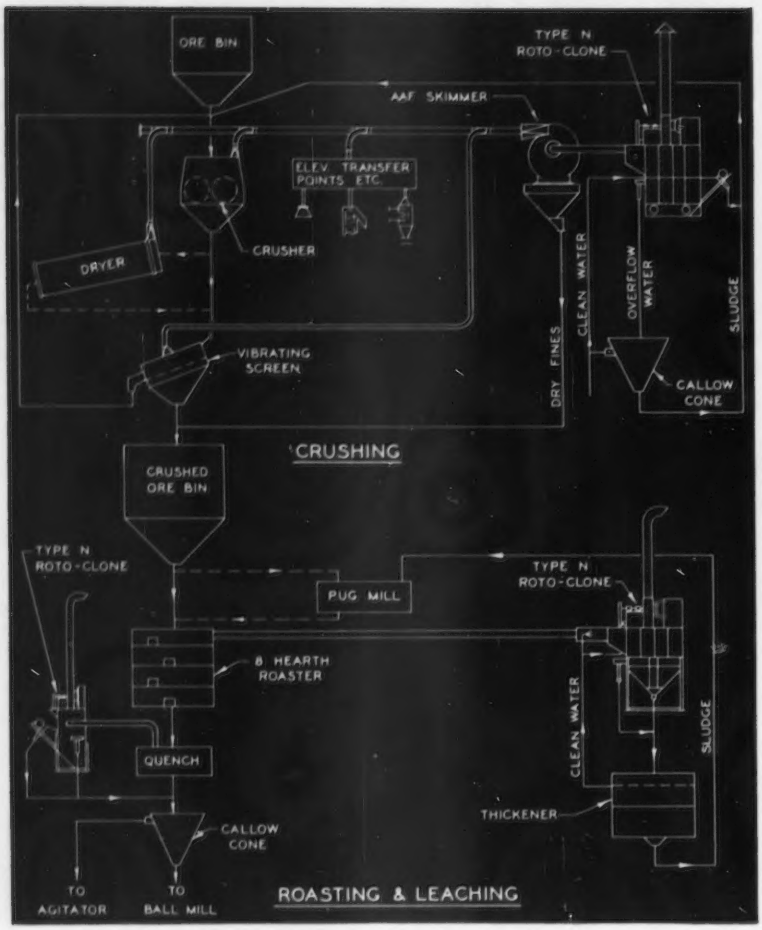
for mining engineers

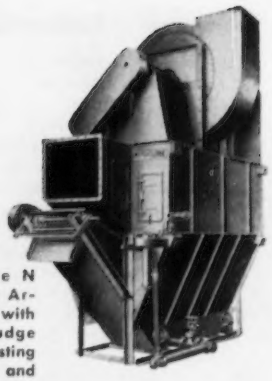
- Ideal for preliminary and supplementary surveying
- May be used as compass, transit, level, plumb, alidade, clinometer
- Small, lightweight, only 9 oz., 2¼"x3"x 1⅛"...easy to carry in pocket, on belt.
- Shows direction to 1°...level, slope or grade within 1°.
- Used in hand or on tripod.
- *Made to last a lifetime.*

*BRUNTON a registered trademark of

WM. AINSWORTH & SONS, INC.
2151 Lawrence Street Denver 2, Colorado
Over 50,000 Brunton Transits since 1896
See your engineering supply house or

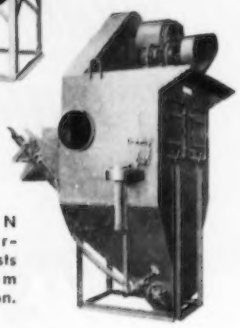
WRITE FOR CATALOG
Please send Free Brunton Transit Booklet
Name
Address





No. 24 Type N ROTO-CLONE Arrangement C with automatic sludge ejector, exhausting dryer, crusher and vibrating screen.

No. 16 Type N ROTO-CLONE Arrangement D continuous sluicing of sludge exhausting roaster.



No. 2½ Type N ROTO-CLONE Arrangement C exhausts 2,500 cfm from quenching operation.

ROTO-CLONES Prove Benefits In Uranium Beneficiation

Dust problems eliminated—high-value fines recovered

IN the recent past, a large reactivated uranium mill achieved increased efficiency by utilizing a new process for continuous leaching of carnotite ores. As a result, they also developed unwanted new dust sources.

AAF ROTO-CLONE dust control equipment provided the solution—it eliminated the process dust created by critical operations and also permitted recovery of the high-value fines (these fines were found to contain from 4 to 7 times *more* uranium than the run of ore).

The right equipment backed by men who *know* industry's dust problems—that's the combination that consistently comes up with the *right* answers. For the answers to *your* dust problems, call the man who "knows" in your area—your local AAF representative—or write direct to—

American Air Filter
COMPANY, INC.
193 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

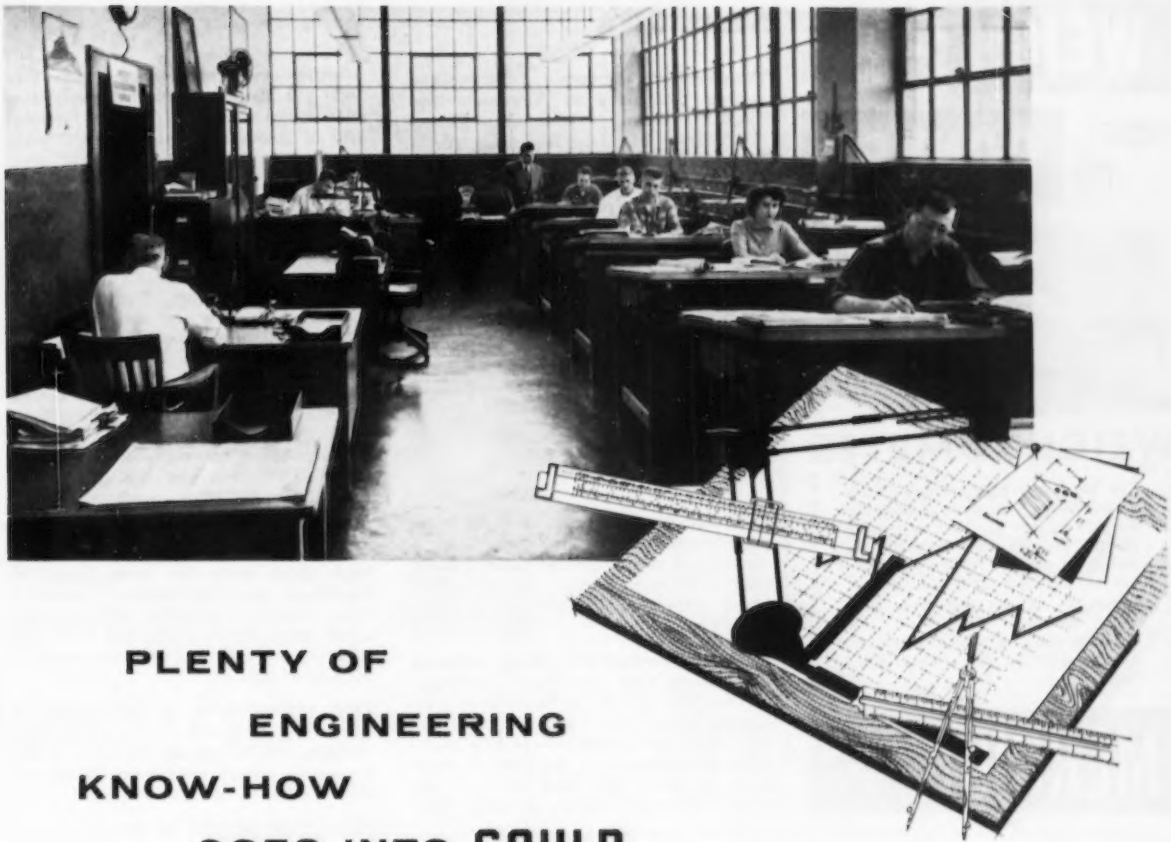
AAF Dust Control Equipment

Air Filters and Precipitators

— BETTER AIR IS OUR BUSINESS —

Cycoil Oil Bath Air Filters

Herman Nelson Unit Heaters



PLENTY OF ENGINEERING KNOW-HOW GOES INTO GOULD RESEARCH BUILT BATTERIES!

On the drawing boards in the Gould engineering department, theory is made practical. Drawings and specification charts indicate the right plate size, battery case size, the eventual battery capacity, how grids should be cast, how active material should be mixed and how the battery should be constructed—to make sure you get the right battery for the right job!

One more reason why you get better batteries first from Gould!

America's Finest!
GOULD
Shuttle Car and
Locomotive Batteries

Always Use Gould-National Automobile and Truck Batteries

GOULD
Batteries

GOULD-NATIONAL BATTERIES, INC.
TRENTON 7, N. J.

"BETTER BATTERIES THROUGH RESEARCH"

©1955 Gould-National Batteries, Inc.

WEIGH WITHOUT STOPPING

WHILE YOU **CONVEY**

Yes, weigh and record with the —MERRICK

WEIGHTOMETER

The Merrick Weightometer provides a continuous, automatic, accurate weight record at any designated point in the mill, while material is in motion on conveyor. It weighs without interrupting conveyor service. Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

MERRICK SCALE MFG. CO. PASSAIC N. J.

VENEZUELA

Combined iron ore output of the two iron mining companies in Venezuela was 5,420,597 metric tons. Orinoco Mining (U. S. Steel) and Iron Mines Co. (Bethlehem Steel Corp.) are the only active producers. Large reserves blocked out by Maria Luisa Ore Co. and El Trueno Concessions have not been opened as yet. National government is holding in reserve the largest and most important concession, San Isidro-Santa Barbara-San Joaquin.

Gold mining output was 1,744,089 grams, while industrial and gem stone diamond production hit 96,982 carats.

IN AFRICA

Gold and uranium production for 1955 reached some $582-million. Some sources say the two metals will be yielding more than $760-million per year by 1958. South African gold output was 14.6-million oz.

Squads of workers have begun work in the Kinross area of Eastern Transvaal for the first of the gold mines to be opened in that virgin area. At least another four, and possibly seven, new properties are expected in the area. Reports from observers hold that the reef lies between 800 and 1200 ft, shallower than any operation on the Reef for several years.

A copper occurrence averaging some 7 to 16% Cu along a strike of nearly two miles is reported from the Fort Jameson area of Rhodesia, where intensive work is under way to determine extent. Best Copperbelt values run between 5 and 6%.

African Explosives and Chemical Industries will build a superphosphate plant near Salisbury, Southern Rhodesia, using indigenous phosphates and sulphuric acid produced from pyrites. Plant should be completed in 1958 and meet the entire requirements of the Central African Federation. Cost is set at about $8.5-million.

Latest available figures for mine output in 1955 put value over the $400-million mark in the Belgian Congo, which still produces about half the world's uranium, 75% of its cobalt and 70% of its diamonds. Profits after taxes of Union Miniere de Haut Katanga for 1954 was reported at £35-million.

High grade iron has been found in Swaziland, near the Havelock Asbestos mine. Deposit is hematite, with an indicated grade of 64% Fe and 3.5% Si. Reserves are estimated between 40- and 50-million tons.

First mining school in East Africa is being established at Kilembe, in Uganda. Africans will be trained for work in the territory's copper and cobalt mines to serve as team leaders and artisans.

Mechanized removal of overburden is under way at two open pits of alluvial diamond deposits at the Kanshi and Disele mines, Bakwanga, Belgian Congo. Highly argillaceous sands up to 65 ft deep and 4,000 ft wide are being removed by a chain excavator which handles 803 cubic yd per hour on a 118 ft long belt. Equipment was made in West Germany.

Rutenburg Platinum mines will increase output by 50% over the next year or so. Observers estimate that current production at the mines—only major producer of platinum metals in South Africa—at around 300,000 oz per year. Expansion will cost about $7-million.

Progress report by the French aluminum company "ALUCAM" issued recently states that first production from the new plant at Edea, in the French Cameroons, is expected late in 1956. New plant, largely owned by Pechiney and Ugine—France's chief aluminum producers—began building in 1954 and will be completed in 1958. When finished, it will have an annual capacity of 45,000 metric tons.

Exploitation of iron ore deposits at Fort Gouraud in French Mauritania, one of Africa's richest known deposits, has definitely been decided upon by the concession-holder, Societe des Mines de Fer de Mauritanie. Known reserves at Fort Gouraud, which lies 235 km east of the Atlantic port of Villa Cisneros in the Rio de Oro, are 100-million metric tons and substantial areas remain unstudied. The ore is of very high quality, ranging from 66 to 86% iron.

INTEGRITY COUNTS in PUMPS, Too

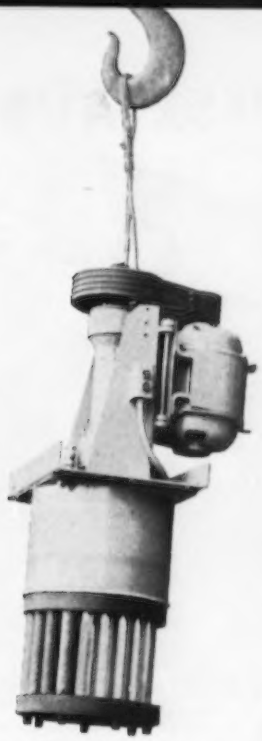
This DISTINGUISHED PUMP will win your RESPECT
TYPE OJ
Aurora Horizontally Split Case, Double Suction, Single Stage Centrifugal Pump
For general water supply for municipalities, industries, office buildings, institutions—also—for handling liquids, chemical solutions, oils etc., in a wide variety of industries. Write for Bulletin 105-BM for further details.
AURORA Always PUMPS

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA® PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
86 LOUCKS STREET • AURORA • ILLINOIS

ONE DEAD CELL

but this WEMCO Fagergren still produces



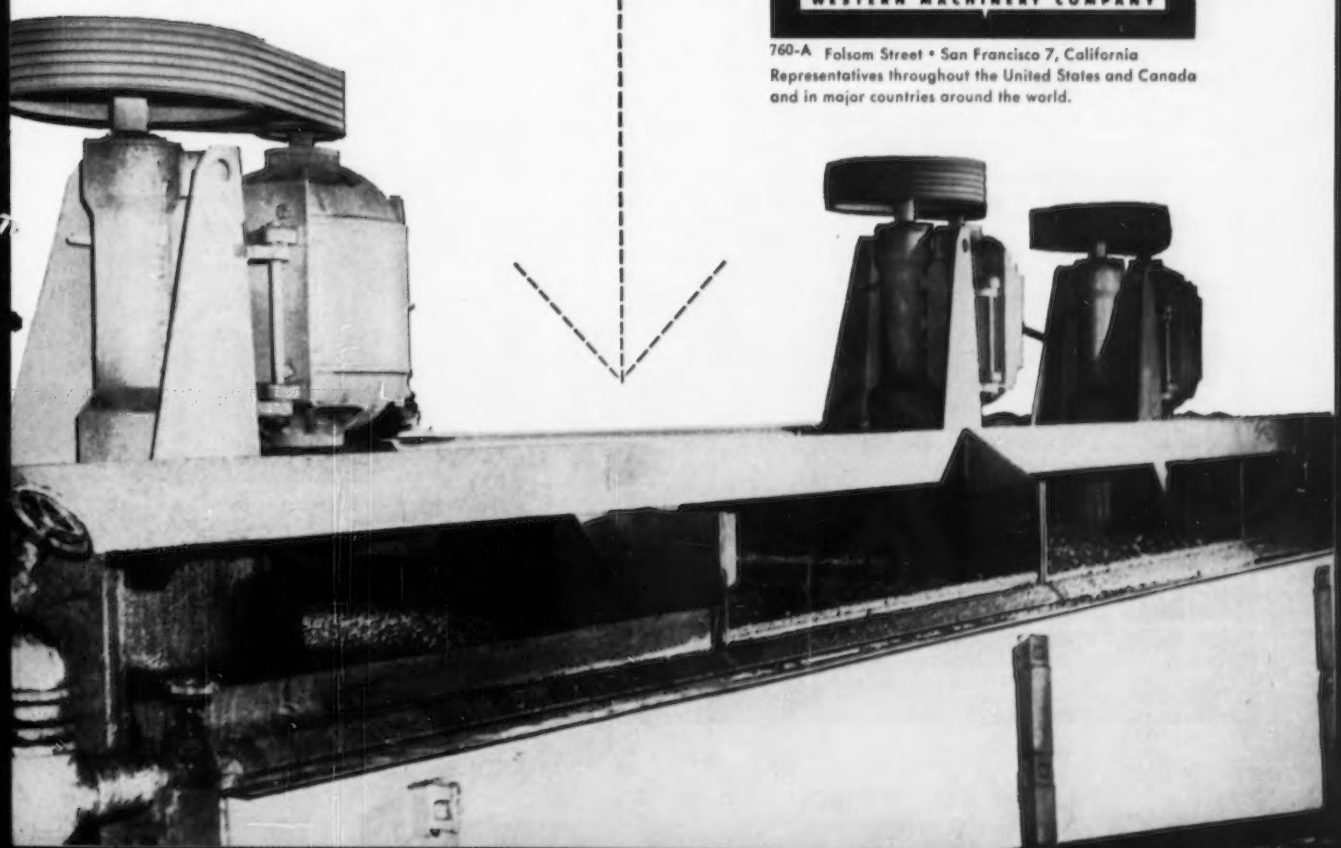
There is no down time when a Wemco Fagergren mechanism is lifted out for service. The bank of cells continues to produce without interruption. Sanding up of the inactive cell is no problem. When the serviced unit (or a spare) is returned, it simply digs its way back into position.

Over half the world's flotation tonnage is produced in Wemco Fagergrens. Operating convenience and easy maintenance are among the reasons both large and small plants choose these machines. High recovery and low reagent consumption are other deciding factors.

For the full facts on how Wemco Fagergren Flotation Machines can *cut your operating costs*, write today for descriptive literature.

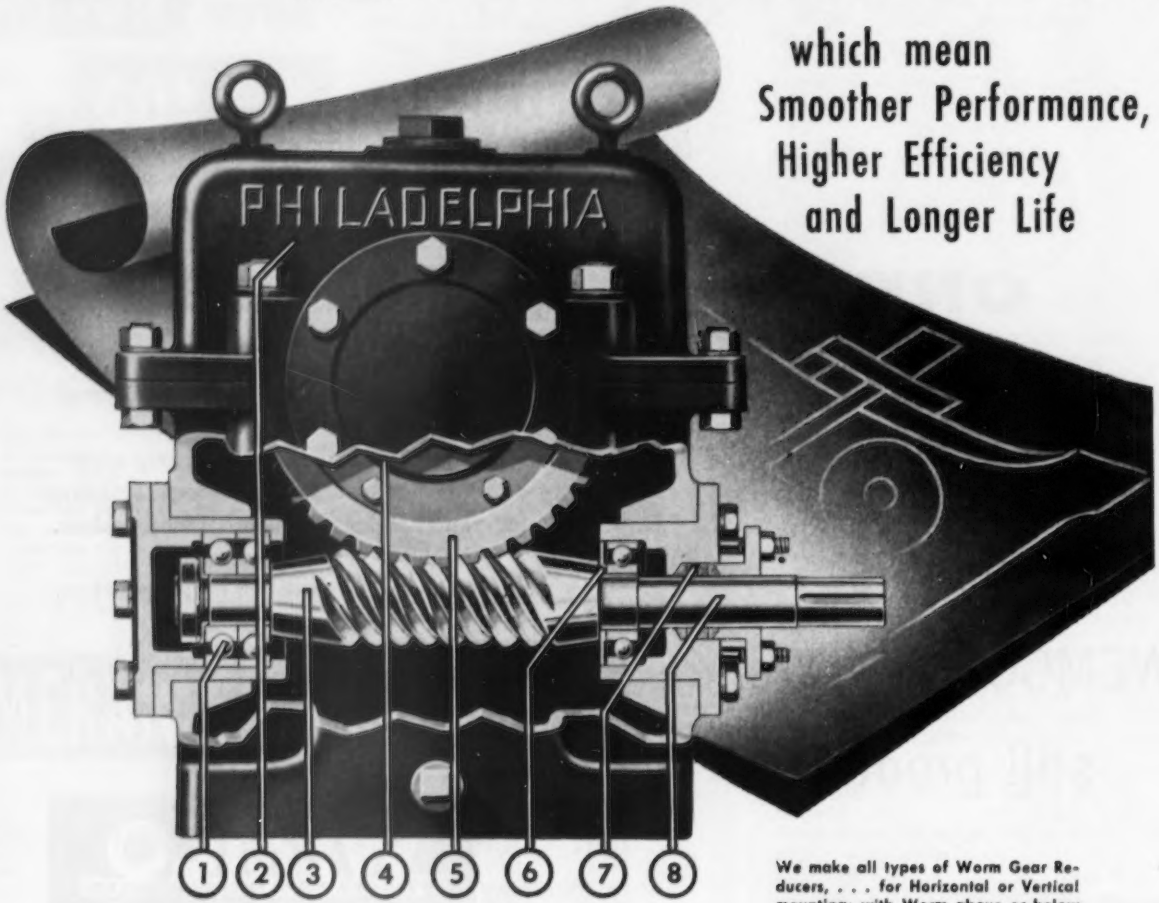
WEMCO
WESTERN MACHINERY COMPANY

760-A Folsom Street • San Francisco 7, California
Representatives throughout the United States and Canada and in major countries around the world.



YOU GET ALL THESE ADVANTAGES . . .

which mean Smoother Performance, Higher Efficiency and Longer Life



1____ **BEARINGS** throughout are of highest quality, calculated to take all loads and stresses in accordance with maximum ratings of units.

2____ **EXCEPTIONALLY RIGID HOUSING** of best grade cast iron . . . Strengthening ribs integral with design.

3____ **WORMS** made of SAE 3115 Steel with carburized and hardened threads. Shaft and threads smoothly ground after hardening.

4____ **GEAR SHAFT BEARINGS** run in an oil well that automatically fills with fresh oil when filled from top. Splash from the gear keeps the wells filled to the overflow point.

5____ **WORM GEAR** made from quality chill cast nickel bronze bolted to a semi-steel center. (Smaller sizes are solid bronze.)

6____ **WORM AND WORM BEARINGS** run in oil bath. Baffle plates prevent flooding.

7____ **WORM SHAFT** equipped with stuffing box to prevent oil leakage.

8____ **SHAFTS** are premium quality. Always accurate, straight, concentric.

We make all types of Worm Gear Reducers, . . . for Horizontal or Vertical mounting; with Worm above or below Worm Gear; in Single, Double or Triple Reductions for medium or heavy duty service; any horsepower or reduction ratio.

Tell us your Speed Reduction problems, and a Philadelphia Sales Engineer will gladly call upon you, . . . without obligation.

Catalog WG-51 sent upon request on your letterhead.

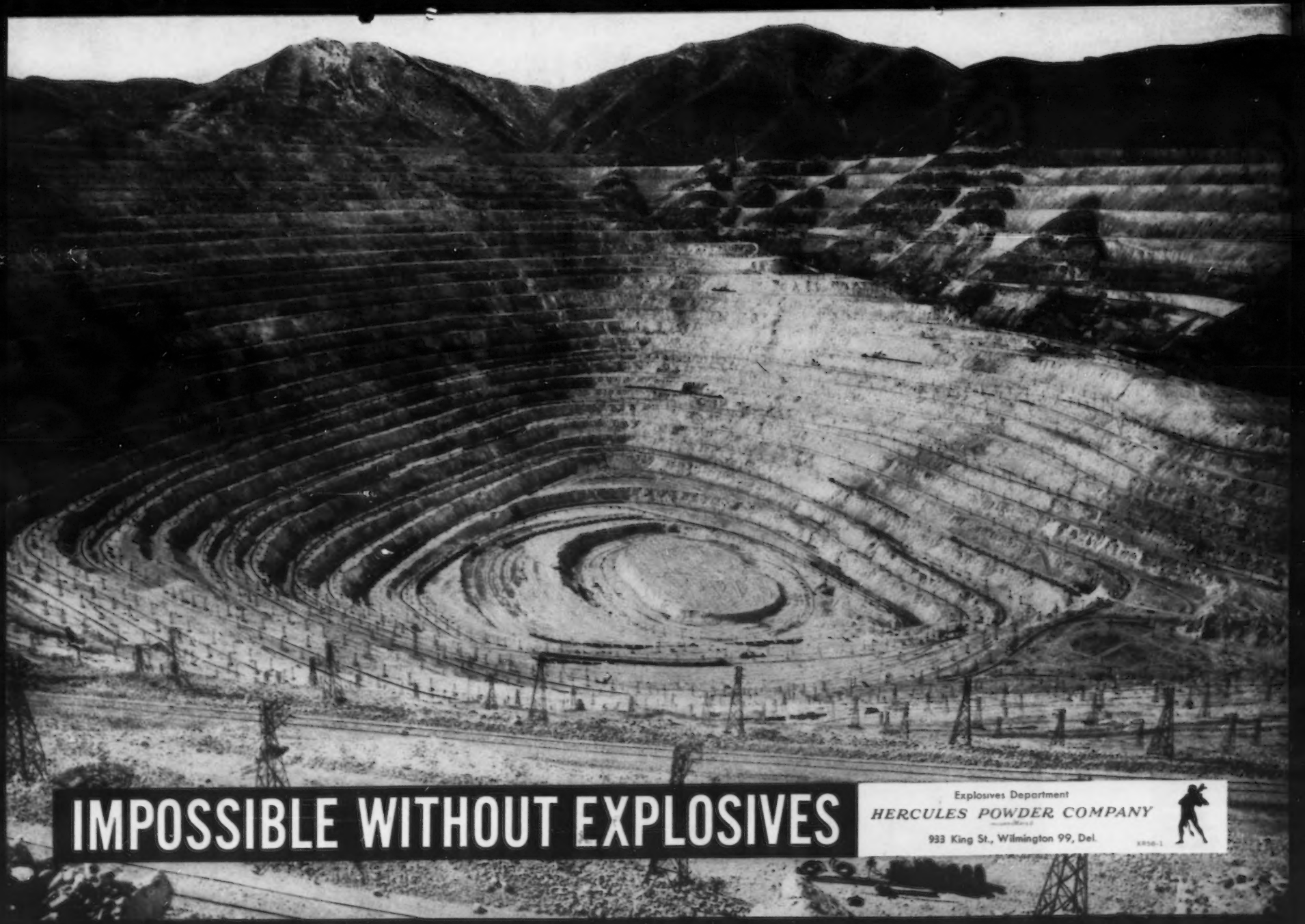
PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
Virginia Gear & Machine Corp. • Lynchburg, Va.

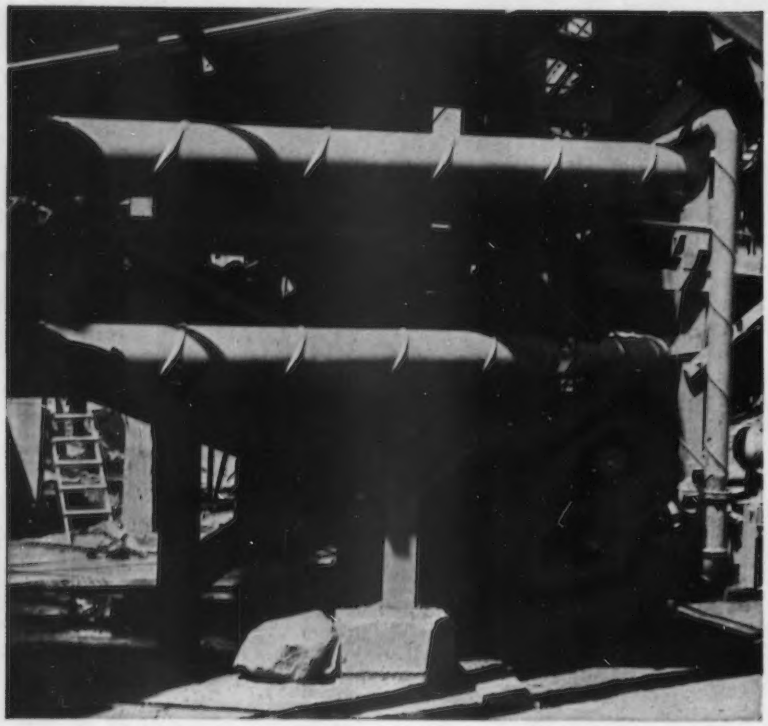
Industrial Gears & Speed Reducers

LimiTorque Valve Controls

Established 1892


IMPOSSIBLE WITHOUT EXPLOSIVES
Explosives Department
HERCULES POWDER COMPANY
933 King St., Wilmington 99, Del.

There's Extra Performance in Every SPIRAL



The familiar SPIRAL that distinguishes Naylor from all other pipe in mining service is not just an identifying feature. It tells you that the pipe is light in weight, therefore easier and more economical to handle and install. It's your assurance that the pipe is extra strong and extra safe because Naylor's exclusive lockseamed, spiralwelded structure acts as a continuous expansion joint to absorb shock loads, stresses and strains. And it's evidence of the greater collapse strength that permits operation under either vacuum or pressure.

Specify Naylor for high or low pressure air and water lines, ventilating pipe, tailings lines and for other lines — to get this extra performance.

Write for Bulletin No. 507.

NAYLOR PIPE

NAYLOR PIPE COMPANY
1243 East 92nd Street
Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

IN THE PHILIPPINES

Atlas Consolidated Mining & Milling Co. milled 129,000 tons in November and produced 3821 tons of 19.63 copper concentrates from its Toledo mine. It is announced that its present capacity of 6000 tpd will be increased to 10,000 tons by October 1956. Ore reserves are reported to be in excess of 50-million tons of 1% copper.

Good progress has been made by Itogon Mining Co. during the year in spite of the generally unfavorable conditions for gold mines. Company paid up its indebtedness of $500,000 to the Reconstruction Finance Corp. four months ahead of time. Production has been running about 2800 oz gold per month from milling 15,700 tons, with an average recovery value of 0.18 oz per ton.

Baguio Gold's production in November was 1932 oz gold from 11,200 tons milled, an average recovery of 0.17 oz per ton. Total value was £296,000, or £26.40 per ton ($13.20). Value is computed on basis of current market price for gold and the gold subsidy price, which accounts for the increase over the statutory price.

IN AUSTRALIA

The year 1954 was one of vigorous activity and consolidation of the Australian mineral industry. There were two clear trends which have continued into 1955; a well-maintained production supported by buoyant prices and considerable exploration activity stimulated by public interest in oil and uranium.

Total value of mineral industry output during 1954 was A£182,832, according to P. B. Nye, director Australian Bureau of Mines.

1954 Production (tons)	
Antimony	425
Cadmium	288
Copper, blister	38,047
Copper, refined	29,287
Pig iron	1,859,114
Lead, refined	200,409
Selenium	3,442
Tin, refined	2,063
Zinc, slab	102,289

Mt. Isa Mines Ltd., in which American Smelting and Refining Co. holds a large interest, has strong indications of extension to its copper orebodies in the Mt. Isa area. Exploratory diamond drilling and underground development have lead to the discovery, and ore intersection revealed an economic width and good grade of copper ore. Further drilling has been ordered.

Company had also proved the existence of large quantities of low gradé silver-lead-zinc material which are uneconomic under present metal prices and operating costs.

B.F.Goodrich

Tires carry 40 tons of coal over 25,000 miles of rocks—ready for more

ONE of the world's largest strip mines is operated by the United Electric Coal Companies at DuQuoin, Illinois. Here fleets of trucks carry 40-ton loads of coal from rock-strewn pits over long haul roads made of abrasive slate. Tires could be chewed to pieces quickly, running up huge maintenance costs, running down production.

United avoids these problems with B. F Goodrich tires, reports they have averaged 25,000 miles already with less than half their service life gone!

All-Nylon cord body

Universal tires can take this kind of punishment because they're now built with an *all-nylon* cord body (size 12.00 and larger, smaller sizes in rayon or nylon). Nylon is stronger than ordinary cord materials, can withstand double the impact and resist flex breaks.

Under the tread is the patented B. F. Goodrich nylon shock shield. Layers of strong nylon cords stretch together to absorb shocks and protect the tire body Universal tires wear longer; more tires can be recapped. You pay nothing extra for this nylon shock shield.

See your B. F. Goodrich representative today and find out how you can get longer tire service at lower cost in your mine work. The address is listed under Tires in the Yellow Pages of your phone book. Or write *The B. F. Goodrich Company, Tire & Equipment Division, Akron 18, Ohio.*

UNIVERSAL TREAD resists rock cuts and bruises. Wedge-shaped cleats defy slippage, pull in either direction.

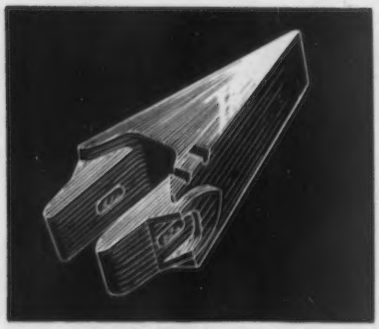
OVER-ALL VIEW of the giant DuQuoin mine. It's one of 6 operated by United in Illinois and Kentucky

Specify B. F. Goodrich tires when ordering new equipment

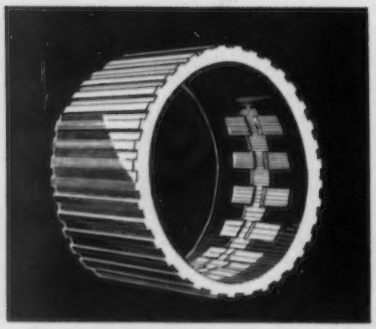
RESEARCH KEEPS B.F.Goodrich FIRST IN RUBBER

TISCO® CAST ALLOY WEAR PARTS

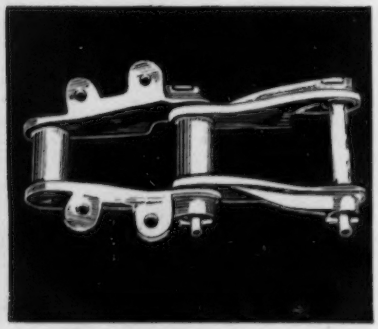
are used by leading Machinery Manufacturers



Dipper Bucket Tooth

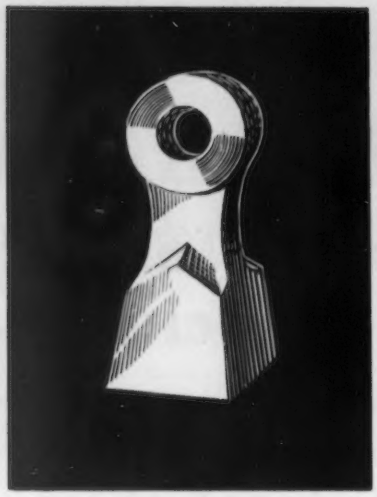


Roll Shell

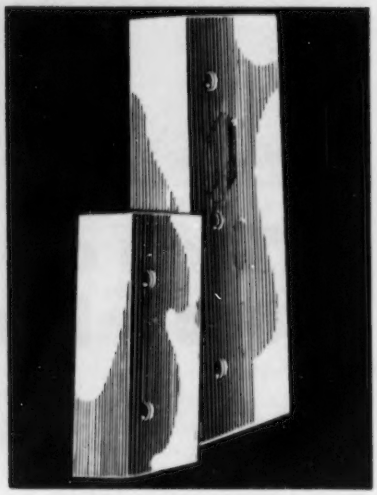


Elevator Chain

Gyratory Crusher Mantle



Hammer Mill Hammer



Ball Mill Liners

Many prominent manufacturers have profited from Taylor-Wharton's outstanding contributions to the solution of problems of impact and abrasion in the working parts of heavy duty machinery.

More than sixty years ago TISCO, the first High Manganese Steel made in the United States was introduced. It is still tops for resistance to a combination of heavy impact and abrasion. More recently, however, newer alloys of notable characteristics, more suitable for specific wear conditions, have been developed

For example, TISCO 150-Y has strong resistance to heavy abrasion, without impact. It is excellent for extrusion augers, scraper blades, agitator blades, mixer paddles and other parts with similar wear problems. It is a high chrome cast alloy capable of heat hardening to 700 Brinell.

TISCO #50 Alloy is another useful material of outstanding abrasion resistance, and fair impact qualities. It is widely used for ball and rod mill liners, bushings and like applications. A medium manganese chrome molybdenum alloy, it can be hardened to 300-500 Brinell.

Taylor-Wharton Metallurgists are at your service. If your problem is impact or abrasion (or a combination of both) get in touch with us.

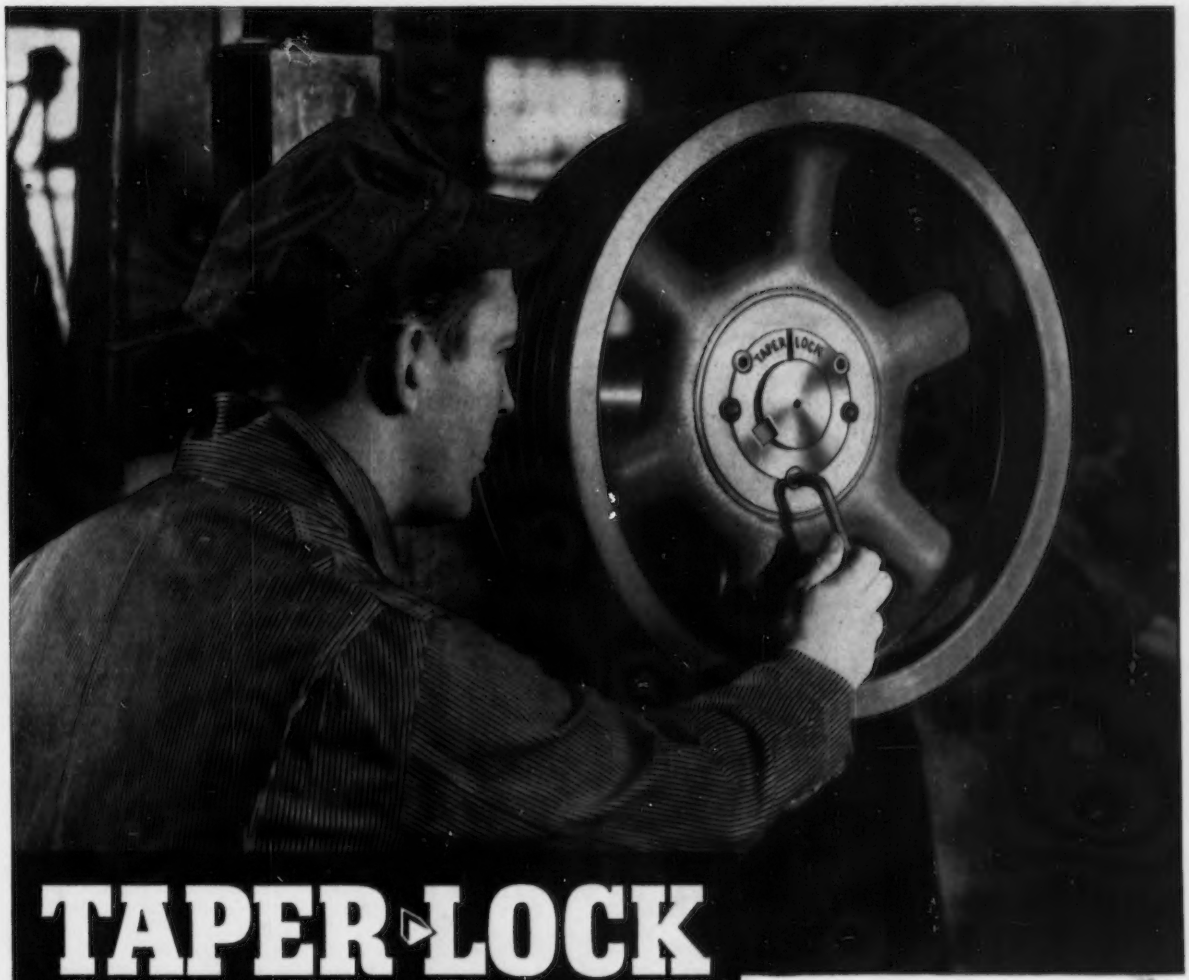
Use Timang Weld Rods and Shapes for rebuilding and repairing worn parts made of manganese steel.

TAYLOR-WHARTON DIVISION

HARRISBURG STEEL CORPORATION

HIGH BRIDGE 1, NEW JERSEY

Birmingham, Ala. Chicago, Ill. Cincinnati, O. Easton, Pa. New York, N.Y.



TAPER-LOCK

A PATENTED PRODUCT OF DODGE

The simplest, surest means of mounting wheels to shafts!

Slip it on the shaft, line it up and tighten while sighting! Mount sheaves, sprockets, couplings, conveyor pulleys *quicker*—and more easily—with Taper-Lock bushings. A few twists of a hex wrench and Taper-Lock grips the shaft with the firmness of a shrunk-on fit. It comes off as easily, without shock to bearings or machinery. Bushing seats evenly along entire length of the hub—*wheels run true!*

Standardize on Taper-Lock. You save time and money and keep production rolling with these *interchangeable* bushings. See your Dodge Distributor, or write us for the full Taper-Lock story.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.

THERE'S ONLY ONE TAPER-LOCK, THE BUSHING THAT MOUNTS FLUSH!

Standardize, economize with Taper-Lock, the bushing that is interchangeable in Dodge sheaves, sprockets, couplings and conveyor pulleys. *More than 2,000,000 in use!*

DODGE

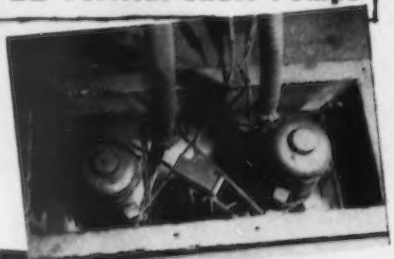
of Mishawaka, Ind.

DODGE MANUFACTURING CORPORATION, 3100 UNION STREET, MISHAWAKA, INDIANA

Good Housekeeping at Climax Molybdenum
Made Possible By NAGLE Vertical Shaft Pumps

Climax Molybdenum Co., Climax, Colo., is just the kind of mining operation for which Nagle Centrifugal Pumps were tailor-made. Climax has 18 Nagle Vertical Shaft Pumps on the Job—type "SW-OB" and type "QW" —for sump service, drainage and slurry handling.

ALL Nagle Pumps are designed for abusive service—for the gritty, grueling, punishing jobs. At many mining operations Nagles are economically handling mixtures of coarse materials, slurries, slimes, etc., in many types of applications. No stuffing box or bearing troubles, no leakage. Absolute minimum of maintenance. Get the complete story—send for Catalog 5206.



NAGLE PUMPS

NAGLE PUMPS, INC.
1239 CENTER AVE., CHICAGO HEIGHTS, ILL.

PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

It's MineVent Flexible Ventilation Tubing -- Of Course!

THIS 36" dia. MineVent Tubing with patented Snap-on Coupling and Type B Hangers is bringing fresh air to the working face in this non-metallic mineral mine. MineVent is preferred for all underground mining because it is light in weight; abrasion, moisture and corrosion resistant; easier to couple, hang or store. Also, Neolon Tubing has all the qualities of MineVent plus lighter weight and utmost tear resistance. Send for samples and catalog.

AMERICAN BRATTICE CLOTH CORP.
220 S. BUFFALO STREET, WARSAW, INDIANA

Australia *(Continued)*

Exploration and diamond drilling by Mt. Lyell Mining Ltd., a Tasmanian producer of copper, has indicated enrichment and continuation of the main orebody under the open cut. It is expected that the company will have to make substantial additions to its present 25 year mining schedule. In the current fiscal year, however, the company's output of ore and copper concentrates will be reduced.

This is due to shortage of skilled labor, which has delayed cutting of a new deep approach adit which had to be driven through barren rock to open up a new bench. A new crushing station is to be erected at the south end of the open cut and a 3800 ft tunnel would be constructed to provide a new ore pass. Orders have recently been placed for equipment for extension of concentration plant.

Continuous production is starting at Northern Hercules' N.L. new mill but grade of ore is lower than average because a substantial portion of the mill feed is dump material obtained from development work. 3,000 tons of ore are awaiting treatment. Throughput of ore will be less than the planned 100 tpd for a few months.

Fijian gold producer, Emperor Mines Ltd. (Australian-owned and controlled) had good results from the eastern portion of its No. 9 level. The open cut was practically exhausted and all ore production is now underground. Development work had started from Nos. 10, 11 and 12 levels. During the sinking of the shaft, several intersections of ore were met and some of them were of good grade. Churn drilling further to the east has also indivated orebodies.

Exploration in Netherlands New Guinea has revealed existence of rich nickel and cobalt deposits in the Cyclope Mountains. Proved reserves are for the present estimated at some 600,000 tons nickel and some 80,000 tons cobalt, both of high content. This is probably only part of the actual wealth. It is stated that the deposits would justify the establishment in Neth. New Guinea of an ore processing plant. A great difficulty is the lack of labor.

NEW CALEDONIA

"Le Nickel," French mining company operating in New Caledonia, has agreed to furnish the Broken Hill Co. of Australia with New Caledonian iron ore, according to an announcement made in Paris. A new company will be formed for the purpose, with Le Nickel holding 82% of the stock, Broken Hill 10%. Remainder will be owned by local interests in New Caledonia.

According to the report, the initial contract calls for the delivery of 160,000 metric tons of ore per year to Broken Hill's furnaces at Newcastle and Port Kembla in New South Wales. It is expected that shipments will ultimately reach 300,000 tons annually.

an ACCO product

American Cable TRU-LAY VHS 15% STRONGER

New VHS Dragline Lasts 73% Longer

Draglines on the excavator above, used in coal stripping operations at the Kingston Mining Company, Plymouth, Pa., get really rough service. The best Improved Plow Steel lines formerly lasted only 700 hours.

Now, however, lines of new TRU-LAY VHS are averaging 1,250 hours —giving 73% longer service life.

Records like these are being duplicated by VHS Draglines all over the country. For new VHS is tougher—more wear resistant. And it has all the advantages of preformed construction.

STRONGER AND SAFER

New VHS is 15% stronger than Improved Plow Steel, which was the strongest available until now. Its additional strength enables you to handle heavier loads with the same diameter line. And it gives you a higher factor of safety during the entire service life of the rope.

FOR SHOVEL HOIST ROPES AND SLUSHER ROPES, TOO

TRU-LAY VHS was developed particularly for the toughest applications in the mining industry — draglines, shovel hoist ropes and slusher ropes. It stands up better under the rough treatment these ropes necessarily get.

LESS "DOWN TIME"—CUTS COSTS

Because it is tougher and more wear resistant, TRU-LAY VHS rope lasts longer, costs less to use and cuts "down time" of equipment for wire rope replacement.

TRU-LAY VHS ropes are easy to order. Just ask for TRU-LAY VHS Shovel Hoist Ropes, Slusher Ropes or Draglines, in the size you want. You don't need any complicated specifications.

Your American Cable Distributor has TRU-LAY VHS *in stock now. See him or write to the nearest American Chain & Cable Company Office.*

ACCO

American Cable Division

AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

PRONTO URANIUM MINES

BLIND RIVER
ONTARIO
CANADA

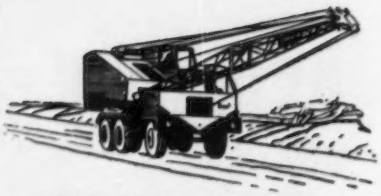
SERVES MANY JOBS, MANY AREAS WITH A LORAIN CRANE

Remotely located in Ontario, Pronto Uranium Mines are constantly building new facilities. Their project is large and scattered, but their 15-ton Lorain Moto-Crane, model MC-254, with its travel speed of 33 m.p.h., quickly moves to many locations to handle jobs of all kinds. On jobs like this, Lorain Crane mobility and work capacity pay off in time-saving performance. Big, multiple tires are ideal for soft-ground flotation . . . high tractive effort makes rough going easy. As further proof of work capacity and job versatility, Pronto Uranium Mines also use the MC-254 with a hoe front end for excavating and trenching.

Today, many mines are taking advantage of Lorain Moto-Crane speed and mobility, for all kinds of construction, maintenance and material handling jobs. Jobs like Pronto Mines are good proof, too, that owners count on Lorains for dependable, day after day, year after year performance.

Investigate the complete Lorain line of rubber-tire shovel-cranes. They are available with highway speeds up to 45 m.p.h.—capacities to 45 tons. Crawler-mounted Lorains are available up to 2½ yds. as shovels—61 tons as cranes. Why not call your nearby Thew-Lorain Distributor now and let him give you the facts.

This 15-ton Lorain Moto-Crane, model MC-254, assists on all phases of building construction at Pronto Uranium Mines, Blind River, Ontario, Canada.



LORAIN MC-254 MOTO-CRANE

. . . is made up of three major components, with many outstanding design features in each. Check these typical features:

• **TURNTABLE** . . . "E-Z" controls for effortless action; faster response • 5 identical interchangeable shoe clutches • 19 anti-friction bearings on power shafts and clutch drums • Truss-type reinforced turntable bed—stiffens bed, reduces deflection, maintains alignment.

• **BOOMS** . . . Interchangeable as ¾-yd. shovel, 15-ton crane, clamshell, dragline, hoe • Independent cable crowd on shovel • 2-piece, pin-connected crane boom • Power load lowering device standard • Ability to back-down-the-load • Third drum available • Precision boom lowering device for cranes.

• **CARRIERS** . . . Thew designed and built—specifically designed for shovel-crane loadings • Front driving axle available • Hydraulic assist steering available • Dual drive available—for one-man operation from turntable cab • Travel speeds—10 forward (approx. 33 m.p.h.)—2 reverse • Rear axles on rocker equalizer beams with parallel torque rod system • Double reduction gear driven axles • Through drive—for maximum traction at all times as torque is always transmitted to axle with tractive ability • Air brakes • Big, multiple tires for soft-ground flotation; high tractive effort for off-the-highway travel.

THE THEW SHOVEL CO.
LORAIN, OHIO

More Strength

with Autocar . . .
Nut and Bolt Construction

- **Higher strength, heat treated material used.**
- **Bolts are made to fill holes exactly to assure snug fit.**
- **Nuts and bolts are assembled with heat-treated lock washers under both head and nut for a permanent, tight installation.**
- **Nuts and bolts are fundamental to easy, low-cost maintenance.**

. . . Means more work, longer life, lower cost on the job

HAVE you seen the Autocar "Nut and Bolt" demonstration? You have if you've seen Autocars on the job—on the tough jobs, everywhere!

Autocar Quality starts with "Nut and Bolt" construction . . . the use of nuts and bolts in the assembly of all Autocar Trucks. It's typical of the way Autocars are quality engineered to exact operator requirements . . . for more work . . . longer life.

Find out how Autocar cuts transportation costs . . . for years. See your Autocar representative without delay.

AUTOCAR TRUCKS

AUTOCAR DIVISION OF THE WHITE MOTOR COMPANY, EXTON, PA.

AUTOCAR DIVISION
The White Motor Company, Exton, Pa.

Send me facts about Autocar "Nut and Bolt" Construction

Name_____

Position_____

Firm_____

City_____ Zone____ State_____

26K

FLEXCO

BELT FASTENERS and RIP PLATES

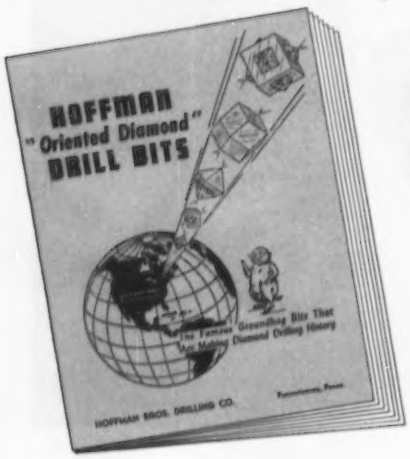
FOR HEAVY CONVEYOR AND ELEVATOR BELTS OF ANY WIDTH

- ★ FLEXCO Fasteners make tight butt joints of great strength and durability.
- ★ Trough naturally, operate smoothly through take-up pulleys.
- ★ Distribute pull or tension uniformly.
- ★ Made of Steel, Monel, Stainless, Everdur. Also Promal top plates.
- ★ FLEXCO Rip Plates are for bridging soft spots and FLEXCO Fasteners for patching or joining clean straight rips.

Compression Grip distributes strain over whole plate area

Order From Your Supply House. Ask for Bulletin F-112

FLEXIBLE STEEL LACING CO., 4635 Lexington St., Chicago 44, Ill.



Find Out How HOFFMAN BITS Save You Money

Send for a copy of HOFFMAN'S new "Oriented Diamond" Drill Bit Catalogue

See how Hoffman Research is producing many other, almost unbelievable advancements in bit design like the Tapered "Step Core" and Miniature Bits shown here. The new Miniature Bits are reducing prospecting labor and costs because they operate from light, ¼ h.p. rigs. By combining drilling and reaming into one operation, the "Step Core" Bits penetrate faster—simplify core recovery—have high speed water release. Yes, it will pay you to find out why so many other drillers are getting better cores, lower footage costs and faster penetration with Hoffman "Oriented Diamond" Bits.

Hoffman Drilling Crews are also available for fast, efficient service on Contract Drilling Jobs.

HOFFMAN BROS. DRILLING CO.
TIONA STREET, PUNXSUTAWNEY, PA.

IN THE NEAR EAST

JORDAN

Manganese has been reported discovered in Jordan, according to the Ministry of the Economy. While claiming a high percentage of Mn, Ministry points out that the mineral is mixed with tin.

Jordan Phosphates Co. will allocate $180,000 for purchase of mining equipment to expand output to 250,000 tons per year. Production in 1955 was 160,000 tons, according to reports.

SYRIA

Finds of sulphur in Gazireh and asphalt in El Boushra have been reported by Sayed Mohamed Ali Sabri, director of the mineral department. Licenses will be granted for prospecting, he said.

ISRAEL

Israel Gypsum Works went into full production (20 tpd) in January at its plant in the Jordan Valley. Output is expected to satisfy all commercial needs except medical for "the next few decades." Firm says output can be raised to 60 tpd if warranted.

EGYPT

Copper mixed with lead has been discovered "in great abundance" in part of the Eastern Desert of Egypt, close to the Red Sea coast, according to the mines and quarries department of the Ministry of Commerce and Industry.

IN EUROPE

GERMANY

West German production of iron ore in 1955 totaled 15,684,000 tons—a post-war record—which compares with the previous post-war highest of 15,400,000 tons, and the 1954 total of 13,036,490 tons, according to industrial sources.

YUGOSLAVIA

Annual output of lead is announced at 80,000 tons, making that nation the second largest producer after USSR in the area; seventh in the world. Zinc output, some 30,000 tons annually, places Yugoslavia in seventh place in world production, according to official sources.

VIBRATING PAN IS THE ANSWER!

Simplicity OS-A-VEYOR feeders lower maintenance and increase operating efficiency . . . LIMESTONE to TACONITE ORE

These Simplicity vibrating pan type feeders have proven themselves throughout the mining and quarry industry. They are not only handling various types of stone and aggregate, but the extremely abrasive taconite ore.

Lower maintenance costs have been proven by long experience in the field. The simplicity of the pan construction allows the unit to be easily repaired with existing materials. These feeders are available with replaceable liners of abrasion resistant steel. The oscillating action is provided by two eccentric shafts coupled to a single V-belt drive . . . leaving only one assembly and four bearings to lubricate.

The Simplicity Os-A-Veyor feeders are self-cleaning units. They experience none of the return spillage found in apron feeders. The Os-A-Veyor feeder will discharge material with a minimum fall, the height of drop is not determined by the size of a sprocket. The units are designed to handle heavy column loads. Overloading the feeders causes no damage, as there is no mechanical connection between the eccentric drive and the main frame or bin.

The Simplicity Os-A-Veyor feeders are main frame supported, or can be supported from the bin with spring and cable suspension, eliminating the need for separate concrete foundation. Sizes available range from 1' x 4' to 6' x 20' with capacities to 1000 tons per hour.

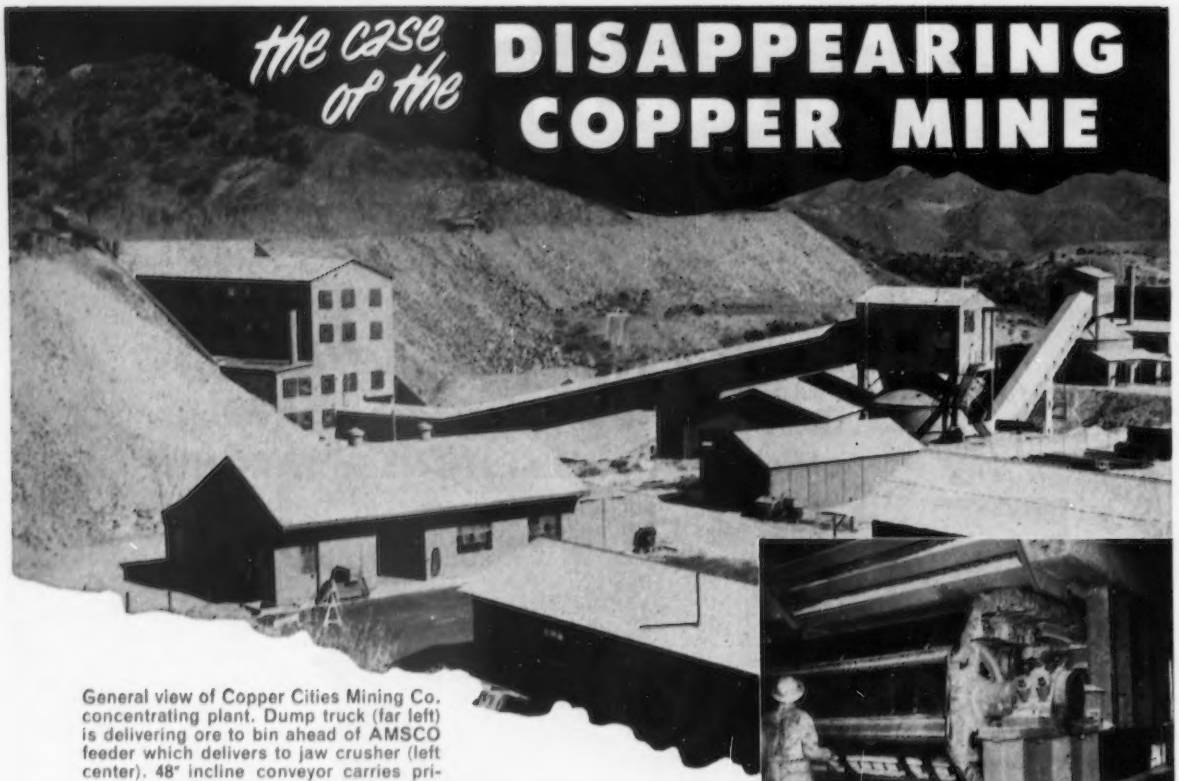
169

If you wish further information on Simplicity Os-A-Veyor feeders, grizzly feeders, horizontal screens or gyrating screens write . .

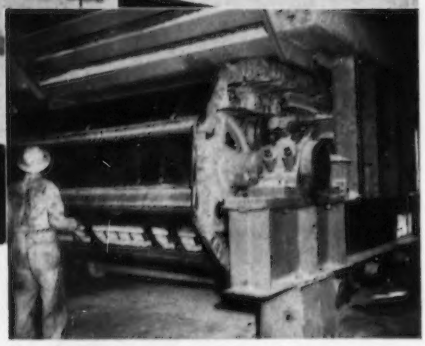
SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown and Sites, 50 Church St., New York 7, N. Y.

Simplicity
TRADE MARK REGISTERED
ENGINEERING COMPANY • DURAND 4, MICHIGAN

the case of the DISAPPEARING COPPER MINE



General view of Copper Cities Mining Co. concentrating plant. Dump truck (far left) is delivering ore to bin ahead of AMSCO feeder which delivers to jaw crusher (left center). 48″ incline conveyor carries primary crushed ore to bins, from where it is fed to secondary crusher. Secondary crush is carried on inclined conveyor to fine crusher building in background.



Huge AMSCO manganese steel horizontal pan feeder, 10′6″ by 25′, has a 20 h.p. drive. Capacity ranges from 500 to 1500 tons of ore per hr. 27,500,000 tons of ore were handled by this feeder before replacement of pan and chain was made. View shows tailshaft assembly, pans, rollers, etc.

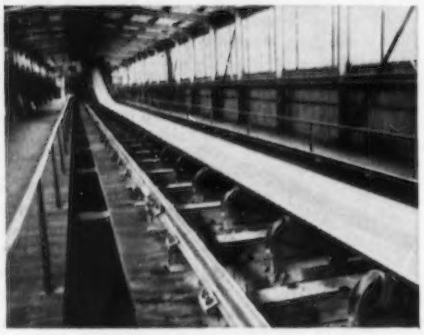
A true story of how ONE S-A conveyor system carried away 41 million tons of ore!

The Castle Dome Copper Mine was finished—its metal ore exhausted. Actual records show that from date of installation until cease operation orders went out about two years ago, 41 million tons of ore from this mine had moved through a STEPHENS-ADAMSON engineered conveyor system!

Castle Dome was finished—but the S-A conveying system, time-tested and toughened by steady usage, was ready and raring for further conquests.

Today, the Copper Cities Mining Company is using this same S-A equipment on its Miami, Arizona properties. And here it is delivering the same steady trouble-free performance as before. In fact, since August 1954, over 5 million tons of copper sulphide ore has been handled at the new site.

Moving these tremendous tonnages the S-A way spells bulk handling with the greatest economy and efficiency that modern engineering and manufacturing skills can provide.



This is the S-A 42″ belt conveyor which carries fine ore over 400 ft. of bins in mill building. In background is motor driven tripper for discharge of belt at any point along its length. Note 6″ diameter SACON idlers which carry belt.

STEPHENS-ADAMSON sales engineers are stationed in every principal city area to serve you. If you have a bulk handling problem, contact the S-A man in your area, or one of our three district offices.

STEPHENS-ADAMSON MFG. CO.

4 Ridgeway Ave., Aurora, Ill.—Los Angeles, Calif.—Belleville, Ontario.

ENGINEERING DIVISION
Designers and manufacturers of all types of bulk materials conveying systems.

STANDARD PRODUCTS DIVISION
A complete line of conveyor accessories—centrifugal loaders—car pullers—bin level controls, etc.

SEALMASTER DIVISION
A full line of industrial ball bearing units available in both standard and special housings.

FIGURE PROFIT HERE, TOO WITH Yellow Strand FLATTENED STRAND WIRE ROPE

You count on track-type tractors, shovels and other equipment for profits. But what about wire rope? You can also figure higher profits by using longer life, more serviceable wire rope.

Yellow Strand Flattened Strand is formed of high quality strands laid up in triangular form (see below) which give you greater contact area that spreads the load over more of the surface. This reduces wear and gives your rope longer life. You get 10% greater strength; you get a wire rope that many owners report lasts up to twice as long as ordinary rope and significantly reduces wear on sheaves and drums. And because it lasts longer, Yellow Strand Flattened Strand saves you much of the time and money lost in frequent rope changes.

So, get Yellow Strand Flattened Strand for longer life, and increased profits. See your Broderick & Bascom Distributor.

COMPARE Yellow Strand FLATTENED STRAND

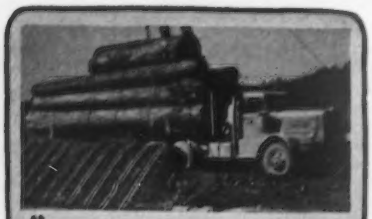
with ordinary (at right) wire rope. In Flattened Strand you have twelve contact points, greater contact area, smoother surface, less wear.

Yellow Strand®

Manufacturers of Wire Rope for 80 Years

Broderick & Bascom Rope Co.
4203 Union Blvd., St. Louis 15, Mo.

American Logging Tool Corporation is a subsidiary of Broderick & Bascom Rope Co.



"THIS LUBRICANT DOUBLES THE LIFE OF GEARS"

—says TRINITY ALPS LUMBER CO. Hayfork, California

"Our trucks have a forty mile county road logging haul over adverse grades, each truck making two complete round trips each working day. Our shop foreman in charge of maintenance, reports that with the use of LUBRIPLATE Lubricants there has been a minimum of truck down time and replacements of bearings and gears. The double reduction gears with LUBRIPLATE APG-140 has shown a saving of fifty per cent over previous operations."

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE

LUBRIPLATE LUBRICATION MAKES CARS AND TRUCKS RUN BETTER AND LAST LONGER

LUBRIPLATE H.D.S. MOTOR OIL . . . THE OIL THAT NEEDS NO ADDITIVES

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

FINLAND

Iron ore mining in 1954 produced 1,519-million tons from 10 Finnish mining companies. Estimated production in 1955 will be 1,710-million and in 1956, 1,860-million tons. Herman Stigzelius, head of Finnish Bureau of Mines, said that iron ore production has been nearly doubled during the post-war years; due to large scale mechanization and rationalization of the work in the mines.

Prospecting that may lead to future mines is being carried on by Outokumpu and an underground exploration program is checking precious metal content of a vein deposit at Sirkka. All the state and private owned mines are conducting an active exploration program.

AUSTRIA

Nationalized Ranshofen Aluminum Werke of Braunau, Upper Austria province, turned out, during 1955, a total of 50,500 metric tons of electrolytic aluminum. This is a distinct increase over 1954 (41,000 metric tons), 1953 (37,800 metric tons) and 1952 (about 31,000 metric tons).

Capacity is now estimated at between 50,000 and 55,000 metric tons.

BULGARIA

Sofia government stated that Bulgaria's first lead-zinc processing center was put into operation during the second half of November 1955. Located near the main deposits near Kirdjali (a mountain village founded for the mining people about 10 years ago), the center is to yield 4,500 metric tons of zinc, 10,000 metric tons of lead and 9,000 metric tons of sulphuric acid per year. Output, expected for 1956 when the center is completely finished, will permit exports.

CZECHOSLOVAKIA

Czechoslovakia announced that the 1955 mining products imported from the USSR did not differ "very much" from the 1954 amounts. These were: 73.7% of all Czech-processed (used) iron ore, 71.8% of all copper ore, 93.9% of crude aluminum and 72.3% of heavy oil.

Czech State Production Plan for 1956 demands that the entire industry raise its output by an average of 9% more than 1955's level. Capital (investment or production) goods will go up by more than 10%, consumer goods by 7%. Production of pig iron will go up by 12.6%, that of iron ore by 18.5%.

IN ASIA

JAPAN

Indonesia may try to improve commercial relations with Japan in 1956, according to reports. Indonesia, it is believed, is seeking the following:

(1) Exports to Japan of some 500,000 tons of nickel ore now held in stock in the Celebes.

(2) Japan's cooperation in developing its nickel mines. Sumitomo Metal Mining Co. is interested in such a venture.

(3) Japanese technical assistance in developing other underground resources such as oil, copper, and iron.

(4) Imports of Japanese rolling stock, probably from Hitachi, Ltd.

(5) A joint Japan-Indonesia firm for economic development of Indonesia may be set up in Japan.

KOREA

Utah Construction Co. has signed contract with the South Korean government for erection of a $2-million, 80 tpd tungsten refinery in Kangwen Province which will hike the country's tungsten output 55%. Plant, to be controlled by the Korean government, will be completed in 18 months.

MALAYA

Tin production this year is expected to exceed 60,000 tons; about equal to last year's output, says government statistical department at Kuala Lumpur. At the end of November 1955, the government says, there were 775 active tin mines against 776 in October.

INDIA

Secretary of the Indian Atomic Energy Commission, Dr. H. J. Bhabha, said that the Government-owned rare earths factory at Alwaye (Travancore-Cochin) would shortly "increase its production substantially."

Factory processes monazite and produces thorium, hydroxide, rare earth carbonates and trisodium phosphate.

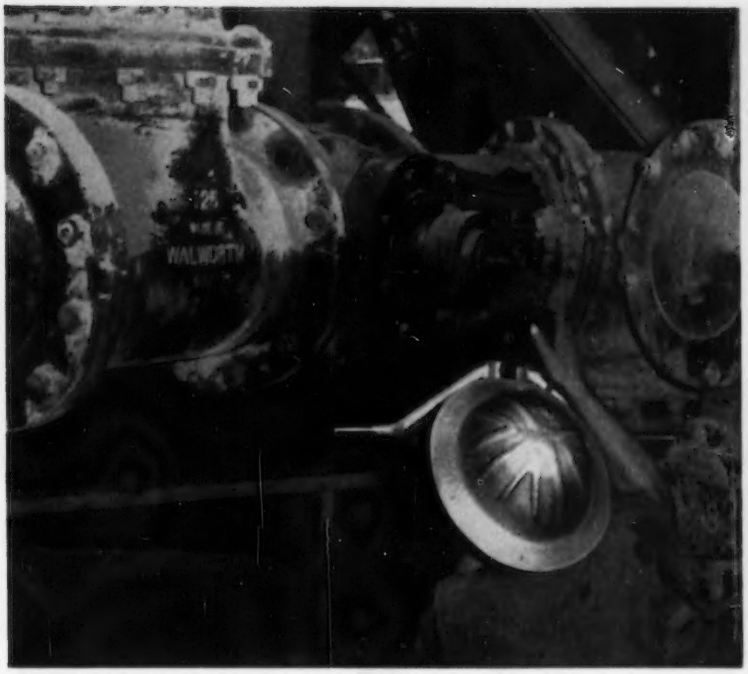
Dr. Bhabha also reports that three deposits of uranium, one in Rajasthan (N.W. India) and two in Bihar, have been located by private prospectors during the last month. Under Indian law, while private prospecting is permissible, once the fissionable material is located, it becomes state property; individual prospectors being entitled only to cash rewards.

Plans for a new 10,000-ton smelter at Hirakud, Bihar, are announced by the Indian Aluminium Co. Ltd. The smelter is to go into production by the end of 1958 and will have a rated production of 15,000 tons per year.

The cost of the project is around $15-million to be raised by shares and loans. Fifty per cent of the new shares are to be taken up by the Aluminium Limited of Canada.

RUSSIA

Russia showed a modest gain in metals and ores trade with non-Communist Europe in 1954 due largely to increased business with Finland, England and Italy.



CEMENT: Lubricating a Walworth Lubricated Plug Valve in a West Coast cement plant.

BEVERAGE: A battery of Walworth Bronze Lubricated Plug Valves installed in the blending department of a distillery.

PAINT: Eighteen Walworth Lubricated Plug Valves in a common manifold installation in the varnish division of a midwestern paint and varnish works.

serving almost any industry you can name . . .

WALWORTH LUBRICATED PLUG VALVES

FOOD: Walworth Lubricated Plug Valves are included in the piping arrangement in this large midwestern bakery.

PUBLIC UTILITY: Straight-way and three-way Walworth Lubricated Plug Valves installed in a modern West Coast sewage disposal plant.

At one time Walworth Lubricated Plug Valves were considered a "specialty item". Here are some of the features that have led to their employment in a wide range of industries as high quality 'all-purpose' valves:

(1) There are no threaded stems or complicated seating mechanisms. (2) Because the plug is always seated in the body, solid matter, which might be in the line contents, cannot wedge between the seating surfaces and prevent a tight closure. (3) The position of the wrench handle, or the marking on the plug shank, or the stop collar, clearly indicate the position of the plug. The operator can see from a considerable distance whether the valve is open or closed. (4) Quick opening and closing of the valve is assured by only a quarter turn of the plug. (5) Lubricant can be renewed while the valve is in service.

Walworth manufactures complete lines of Lubricated Plug Valves in a variety of types and materials for working pressures up to 5000 psi and for vacuum services. Sizes range from ½ to 30 inches.

See your Walworth Distributor or write to Walworth for complete information.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

WALWORTH COMPANY OF CANADA, LTD.

Toronto • Calgary • Montreal

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Mancha 6-ton Trackmaster®
hauls 87,000 tons of ore... at 1.55¢ per ton mile!

A large western metal mine kept accurate records for a year to establish the direct cost of operating Mancha's 6-Ton Trackmaster Diesel Locomotive. Included were fuel, lubricating oil, repair parts and labor, and an allowance based on a complete engine overhaul every 3 years (which may not be necessary).

Here's the work record:

- **87,000 tons of ore hauled.**
- **Worked two shifts a day for 305 days.**
- **7500 ft. haul.**
- **4.8% maximum grade against load.**
- **Pulled 10 cars weighing 4¼ tons on average haul.**
- **All at a total operating cost of only 1.55¢ per ton mile!**

Mancha's Trackmaster is safe to operate, too. Lever operated brake system is quick acting and positive; proper brake-shoe-to-wheel alignment is assured at all times. A heavy guard plate completely protects operator and comfortable cab space enables him to work with less fatigue. And Mancha's patented Trackmaster design is famous for leveling out rough track, preventing derailment and lost time.

There's no complicated multi-speed transmission with clutch adjustment. A hydraulic torque converter delivers power smoothly. This eliminates transfer of sudden shock loads to engine and reduces maintenance on cars, couplers and track. Two-cycle engine with unit injector fuel system eliminates complicated fuel pumps and high pressure fuel lines. Loss of power due to altitude is minimized. The exhaust scrubber is large enough to do an efficient job, compact enough to permit the locomotive to operate where short radius curves and close timbering limit clearances.

You'll find Mancha locomotives in every important mining area in the world . . . busy lowering hauling costs . . . busy increasing mine profits. Write, phone or wire for full details today . . . no obligation.

MANCHA STORAGE BATTERY LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois • Cable Address: Mancha, Chicago

Mancha representatives are located in principal mining areas throughout the world.

Russia *(Continued)*

Official Soviet figures show that the USSR exported $23,189,000 worth of ferrous metals to Western Europe in 1954 compared to $10,308,500 in 1953. On the other hand, Russia's manganese ore exports to this area dropped from $7,239,500 in 1953 to $6,767,250 in 1954, chrome ore exports from $1,873,000 to $764,750, ferrous metal imports from $19,723,500 to $14,192,500, and nonferrous metal imports from $2,691,250 to $1,664,750.

The Soviet Union reported no imports of manganese or chrome ore, or exports of non-ferrous metals in either year.

"Foreign Trade," official organ of the USSR Ministry of Foreign Trade, listed the following Russian metals and ores business with Western Europe in 1954 (1953 comparisons in parentheses), with all figures converted from rubles into dollars at the rate of four for one:

Exports: ferrous metals—Finland $12,570,000 ($8,496,000); England $4,729,750 ($0); Italy $3,005,250 (994,500); Belgium $1,858,750 ($526,750); Turkey $478,750 ($0); Iceland $363,250 ($150,000); Sweden $183,250 ($141,250). Manganese ore—England $4,966,750 ($1,1526,500); Norway $734,000 ($1,380,000); Sweden $671,000 ($1,732,000); Italy $395,500 ($241,000); Belgium $0 ($2,360,000) Chrome ore—Sweden $764,750 ($1,335,750); Norway $0 ($537,250).

Imports: ferrous metals—France $8,628,500 ($11,607,750); Belgium $3,218,750 ($1,956,750); Sweden $1,480,000 ($4,095,750); Finland $862,000 ($1,782,000); England $3,250 ($281,250). Nonferrous metals—Norway $1,048,000 ($1,950,000); France $616,750 ($741,250).

ARSENIC

Abbott Renick
U. S. Bureau of Mines

PRODUCTION of crude and refined arsenic in the U. S. during 1955 was about 13,500 short tons, up 4% from 1954's figure of 13,000 tons. Apparent consumption of white arsenic was 19,000 tons, up 16% (2,500 tons) from 1954. Price of white arsenic remained unchanged at 5½c per lb, carlots delivered—a price which has held since June 16, 1952.

Imports of arsenic trioxide for the first nine months of 1955 were 5,700 tons, compared with 3,500 in the preceding year. Imports of metallic arsenic for the same period totaled 92 tons, with the total for the year expected to increase about 100% from the 59 tons delivered in 1954. Mexico continued to be the principal supplier of white arsenic (89% of total received), with Sweden supplying 83% of the total metallic arsenic•

Arsenic Statistics

(Short tons)

	1954	1955 estimated
Production	13,000	**13,500**
Imports	4,800	**7,600**
Apparent consumption	16,000	**19,000**
Average price per lb	$0.05½	

Gold *(Continued from p 79)*

about the same as a year ago ($1,267-million, as against $1,208-million), but the heavy capital outflow in the last quarter of 1954 strongly influenced the total for the year ended September 1955; for calendar 1955 a substantial decline in net private capital outflow is indicated. Altogether, the U. S. supplied $21-billion to foreign countries, as against $19.2-billion a year previous.

On the other hand, the U. S. received payments for goods and services from foreign countries totaling $19.3-billion, as against $17.2-billion a year previous; this rise principally reflected much larger payments for U. S. merchandise exports than a year ago ($13.9-billion, as against $12.4-billion). The difference between the dollars supplied by the U. S. and those received by it thus amounted during the year ended September 1955 to $1.7-billion, compared with $2.0-billion a year earlier. Of the $1.7-billion paid out net by the U. S., foreign countries added $1.2-billion to their gold and short-term dollar holdings; balance was accounted for to a large extent by changes in their portfolio and direct investments and in their holdings of certain long-term U. S. Government securities.

The lower rate at which foreign countries received gold and dollars

Want to slash operating costs... get more tons per man-shift . . . and higher total tonnage?

Switch to

LONG PIGGYBACK® CONVEYOR

Continuous Haulage Mining

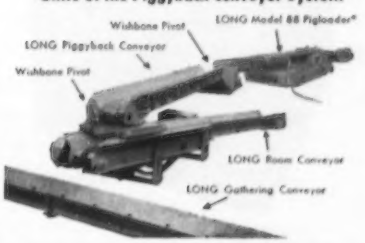
The Piggyback Conveyor system provides uninterrupted haulage from the face . . . eliminates costly loading delays common with "stop-and-go" transportation of other systems.

Every day more and more companies are learning that Piggyback Conveyor mining pays off in greatly increased production at greatly reduced operating costs. In fact, at many mines, this unique system has meant the difference between operating at a profit instead of a loss.

With proved, practical Piggyback Conveyor mining, material is loaded and moved out in a steady, continuous flow—with no down time waiting for intermittent transportation. The result: more tons per man—higher total tonnages. What's more, capital investment per ton for installing the Piggyback Conveyor system is much lower than for any other continuous mining method. Want complete details? Write us today—there's no obligation.

*Trade Mark

Units of the Piggyback Conveyor System



The receiving end of the Piggyback Conveyor is attached to the Pigloader Loading Machine and follows it as it moves. Thus, the operator can devote his full attention to loading. Wishbone pivots make possible continuous haulage at 90° angle breakthroughs.

For complete details or a demonstration, write us today!

The LONG Company

Non-Destructive Analysis of...

Cd, B, Li, Hg, Ir, In, Au, Ag,

and many rare earth elements

Let the Neutron Absorption Analyzer do it for you.

Features:

1. Non-destructive analysis
2. Rapid (approx. 1 minute)
3. Accurate
4. Sampling or continuous control system
5. No sample preparation
6. Gas, liquid or solid samples
7. Simple to operate
8. Employs neutron absorption properties of nuclei.

AUTOMATION-The NEUTRON ABSORPTION ANALYZER principle is readily adapted to continuous control systems for industrial processes.

Reed-Curtis
Nuclear Industries, Inc.

Nuclear Division of
American Electronics, Inc.,
655 West Washington Blvd.,
Los Angeles 15, California.
For additional information
write Dept. 7F1

Field Engineering Offices in principal industrial areas.

Gold *(Continued)*

from the U. S. was therefore due importantly to a larger increase in U. S. merchandise exports than in its imports. More particularly, countries that have relaxed their dollar import restrictions, like West Germany, the Netherlands, the Union of South Africa, and to a lesser degree the United Kingdom, imported considerably more dollar goods. The liberalizing of dollar trade and payments could not, however, be credited with being the principal cause of the rise in dollar imports. These countries experienced a pronounced business boom which pushed up the demand for imports to record levels; and in some of them the sharp rise in demand for goods—not only for imports, but for all goods—brought about renewed inflationary strains. Indeed, the main purpose of dollar liberalization in some of these countries was to obtain imports more cheaply and thereby exert some downward pressure on domestic price levels. The notable rise in imports from the dollar area was, as a rule, accompanied by a smaller increase in exports to that area. An appraisal of the effects of freer dollar trade and payments therefore requires that account be taken not only of the liberalization itself, but also of the economic and financial environment in which it took place.

However, the inflationary strains that have reappeared in the United Kingdom and certain of the overseas Sterling area countries, as well as in some Continental European countries, are less severe than during 1950-51; and the payments difficulties do not appear large in magnitude. Nevertheless, the pace of demand, both for investment in industrial plant and housing and for consumption, has tended in many countries to outstrip available resources, and in some of them has given rise to difficult problems of adjustment. Even more serious are inflationary pressures and balance of payments stresses in certain Latin American and Asian countries; in some of them payments difficulties have been accentuated by a sharp decline in prices in such commodities as coffee and rice.

Yet most countries are in an inherently much stronger financial and economic position, domestically as well as internationally, than only a few years ago. More particularly, industrial production in Western Europe has reached an all-time record and the output of many agricultural and industrial commodities in the primary producing countries has again risen. Remedial action, largely monetary, has been taken in many countries to help re-establish a nearly more sustainable payments position; although in some countries a great deal remains to be done to restore and permanently secure a better balance in the economy, some relief can reasonably be expected.

The renewed inflationary strains and the ensuing balance-of-payments difficulties have slowed down the steady advance toward more multilateral trading and freer international payments that had been under way in 1953 and 1954.

Apart from a very few exceptions, however, there has been no relapse into the more stringent direct controls over trade and payments that had marked the earlier postwar years. Progress during 1955 has, it is true, been more gradual, and has been achieved through numerous relatively small measures of trade and payments liberalization; but these measures, when added to those of the earlier years, have had important cumulative and self-reinforcing effects. Altogether, therefore, last year's developments have confirmed the hope that the domestic economic and financial problems of the major trading nations can be dealt with effectively without reverting to severe exchange and trade restrictions and currency discrimination. They have, however, also showed that a further advance toward freer trade and payments can by no means be taken for granted: on the contrary, it will require a determined effort by each country individually, and by the entire free world, to restore and maintain a reasonable balance, domestically as well as internationally, in rapidly expanding free-market economies•

Silver *(from p 81)*

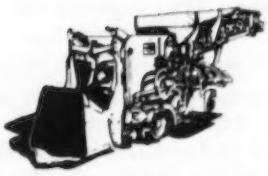
need to bring varying amounts of domestic silver into the market resulted in rather frequent price changes around the Treasury buying price of 90½c. At the year's end the published quotation stood at 90½c.

Legislative developments were of particular significance to silver in 1955. On March 15 a bill (S. 1427), providing for the repeal of existing silver legislation, was introduced in the Senate. It was referred to the Senate Committee on Banking and Currency, which in turn referred it to the Subcommittee on the Federal Reserve, and hearings were held by the Subcommittee July 13, 18 and 25. Further hearings are scheduled to be held in January 1956. The ultimate recommendation of the Subcommittee and the final decision of Congress will be of major importance to the silver market in the coming year.

(Continued on p 248)

12B LOADER

21 LOADER



40H LOADER

THINKING OF REOPENING AN OLD PROPERTY?

Several good mining properties, unoperable only a few years ago, have taken on a new look with present day metal prices.

The cost of setting up to do business has many a mining man weighing the cost against the advantages.

New equipment available today offer many advantages for this work. The Eimco 630 crawler loader for trackless mining provides the ultimate in dependable loading equipment where it is not economical to relay track.

Investigate this sturdy loader — weight approx. 10,000 pounds — 3 tons per minute — operating and maintenance costs less than 1c per ton loaded.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

EIMCO

B-180

You Get "Pay-Off" Performance Every Day with Le Roi-Cleveland Sinkers

... because they have the right force of blow and strong rotation, from proper valve design and port arrangement

That's why Le Roi-Cleveland Sinkers bite into more rock . . . drill more footage per shift. A fast, postive-action end-seating valve, and precise port arrangement, provide powerful force of blow and strong rotation. And this automatic valve meters the air, too. It keeps air consumption down. You get longer life because the performance of this valve is not affected by wear.

Le Roi-Cleveland Sinkers are lubrication-protected. The rifle bar is oiled at every stroke of the piston. This prolongs rifle nut life by 50 per cent or more. That's one of the reasons why you get "pay-off" performance every day in all conditions. Le Roi-Cleveland Sinkers are at their best when the going is toughest.

There's plenty of hole-cleaning power to aid the powerful force of blow and strong rotation of Le Roi-Cleveland Sinkers. They take a fresh bite of rock with every piston blow.

"Pay-Off" performance is really built into all Le Roi-Cleveland Sinkers. Use them to get peak efficiency every day . . . drill more feet of hole per shift. A complete line of Le Roi-Cleveland Sinkers is available from 18 to 80 lbs. Write today for full information.

RD-77

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

How giant jaw crusher is changing the industry

● Here's the giant of them all . . . the *world's first* 4248 overhead eccentric jaw crusher . . . the new PIONEER powerhouse that others are striving to copy.

Until introduction of this crusher, there was no equipment available that completely satisfied the mining industry's need for a crusher which could combine giant capacity *and* low cost. In filling the need, the new PIONEER 4248 is changing the thinking and production methods of the industry.

Big production with 5 big savings

Typical field reports indicate it isn't unusual for a PIONEER 4248 to crush rock at 700 tons per hour with 100% crushing and a jaw setting of only 7 inches.

But at the same time this big crusher is breaking production records, it is also saving you money. Initial cost is much less than that of crushers weighing considerably more . . . installation cost is substantially lower . . . and it costs less to maintain. It also saves drilling and blasting costs because it can take ore up to 40″ x 46″ in size; it saves loading costs because fewer and larger loading machines can be used.

Why maintenance costs less

The PIONEER box-type, all-welded steel base gives added strength with over-all reduced weight. Built like a girder, this construction prevents bending of the sides, distortion and damage to bearings and shaft. Welding methods produce stress-relieved sections . . . thus retaining the original strength of the steel from which the base is fabricated.

Other features which cut maintenance and down time: jaw plates of tough manganese steel are designed to absorb cold flow and peening . . . split jaw plates are reversible for double wear . . . self-aligning anti-friction bearings are precision fit for smooth and lasting performance . . . inner and outer eccentric shaft bearings, mounted closer together than on any other anti-friction bearing crusher, reduce strain. This closeness of bearings, along with patented seal, eliminates areas of excessive stress, thus making an overly-large diameter shaft unnecessary.

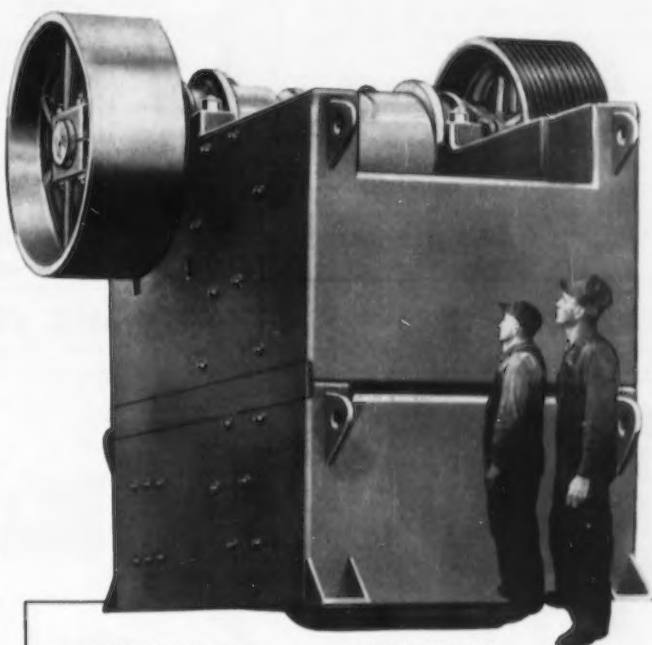
Two tension rods

Twin tension rods offer greater safety. Should one break, the other keeps crusher secure.

In rare cases when repair *is* needed, oil pressure expands inner bearing races so bearings slide easily on the shaft and may be quickly removed for inspection or renewal. A hydraulic ram holds pitman arm forward when you need to replace toggle plate. Split flywheel hubs make renewal and installation simple. Jaw plates can be quickly reversed without special tools.

Ask your crusher salesman these questions:

1. Are bearing housings saddle-mounted to assure constant alignment?
2. Is it possible to remove bearings hydraulically?
3. How closely spaced are inner and outer bearings?
4. Can jaw setting be adjusted by hydraulic means?
5. Can toggle plates be changed with hydraulic assist?
6. Are flywheels provided with split hubs for easy removal?
7. Is crusher made with split base for easy installation?
8. Does crusher have 2 tension rods?



CRUSHER CAPACITY

Field operations indicate that for each inch of jaw opening, capacity increases approximately 100 tph. This rate is with a relatively high crushing percentage. In field installations, production has reached 700 tph with 7″ setting.

SPECIFICATIONS

Jaw opening	42″
Width of jaws	48″
Range of setting	5″-12″
Over-all depth, moving jaw	104″
Over-all depth, stationary jaw	90″
Weight (approximate)	94,200 lbs.
HP required	180-210

For further details, write Pioneer Engineering Works, Inc., Minneapolis, Minnesota (subsidiary of Poor & Company, Chicago) or your nearest PIONEER Distributor.

BUY BOTH! HIGHER OUTPUT LOWER UPKEEP

Pioneer *Continuflo* EQUIPMENT

Pioneer Engineering Works, Inc., 1515 Central Ave., Minneapolis 13, Minn.
Subsidiary of Poor & Company • Chicago
Please send information on equipment checked.

- ☐ GRAVEL PLANTS
- ☐ ROCK PLANTS
- ☐ JAW CRUSHERS
- ☐ ROLL CRUSHERS
- ☐ WASHING PLANTS
- ☐ BITUMINOUS PLANTS
- ☐ APRON FEEDERS
- ☐ ORE FEEDERS
- ☐ MECHANICAL FEEDERS
- ☐ VIBRATING SCREENS
- ☐ BUZZER SCREENS (LIGHT DUTY)
- ☐ CONTINUFLO CONVEYORS

Name _____

Company _____

Address _____

City _____ *Zone* ____ *State* _____

Cut Prospecting Costs

GET A Hossfeld Direct Motor Drive PROSPECTING DRILL

- Powerful Direct Drive
- One Man Operation Throughout
- Economical 5 H.P. Air Cooled Engine
- Lightweight—Compact—Portable

"The Prospector's New Companion"

A Hossfeld Prospecting Drill will cut your drilling costs and give you accurate samplings of deposits as deep as 110 feet. Cuttings and water are brought up continually through the hollow drill steel by the bit check valve for assay at any time, with extremely little loss of water, cuttings or salting.

Hossfeld's "Churn" principle, using water to slush the cuttings, makes it possible to drill through various strata from loose or frozen top soil, mud, and slate, through stratas of hard rock. Equipped with pneumatic wheels, the Hossfeld Drill Operator can easily change drilling operations and move from hole to hole.

EASILY TRANSPORTED

Total Weight: 1,300 lbs. with counterweights. Can be disassembled into 100# units in a very few minutes. Designed for trailer towing, it can be loaded into a half-ton pickup, or trailed in the field on its own chassis behind a car or truck. Or pull it with a burro!

Get all the facts . . . write today for illustrated bulletin giving full details.

HOSSFELD MFG. CO.
440 W. Third St., Winona, Minnesota

BUILT TO SUIT!

ATLAS builds storage battery locomotives to suit "actual" conditions of your operation . . . still using standard, field-proven parts. Ask for a quote on a "special" design and be surprised how easily and economically you can get a machine built to "suit" your needs.

CANADA . . .

Mine Equipment Co., Ltd.
Kirkland Lake, Ontario

International Agencies & Machinery Co., Ltd.
Vancouver, B. C.

THE ATLAS CAR & MFG. CO.
1140 IVANHOE ROAD • CLEVELAND 10, OHIO

Silver *(Continued)*

Treasury free silver stocks increased during 1955 in spite of Government sales to industry of some 10.3-million oz. At Dec. 31, 1955 these stocks amounted to 24.9-million oz, compared with 13.6-million oz at the start of the year. The increase resulted from returns by the Netherlands against their Lend-Lease account. A total of about 23.2-million oz of such returns were credited in 1955. Actually about 11-million oz were shipped in 1954, but not credited until the next year. Total shipments in 1955 are estimated at about 18.2-million oz, of which 6-million had not been credited by the end of the year.

Outlook. Events of the year just ended have emphasized the degree to which governmental policies determine the price of silver. In the past years the Bank of Mexico was the dominant influence. During 1955 attention shifted to the U. S. Treasury Department. Mexico no longer provides the key to immediate market prospects. The future policies of the U. S. are now of primary interest, for these policies will have a vital influence on silver in the coming months.

Assuming no change in the silver policies of the U. S., it would appear that fluctuations will tend to be limited by the Treasury buying price of 90½c per oz for domestic production on one hand, and its selling price to industry on the other. The Treasury's present established selling price is 91c per oz for delivery at the San Francisco Mint and 91c plus 1¼c transportation, or effectively 92¼c, at the New York Assay Office. This price is subject to change at the discretion of the Secretary of the Treasury.

If, on the other hand, S. 1427 becomes law and existing silver legislation is repealed, the Treasury will no longer be obliged to buy silver produced in the U. S. and will have no authority to sell silver to industry, except at the monetary rate of $1.29 per oz. The transfer tax on profits made in trading in silver, which has discouraged speculation, will be eliminated.

Under these circumstances the price of silver would be determined by economic rather than political factors. It would probably fluctuate more frequently and more widely than it has in the past, because the buying of domestic production and the selling of silver to industry by the U. S. Treasury has had the effect of limiting the range of price changes. Without Treasury influence the price would probably drop to lower levels during periods of light demand and rise to higher levels during heavy demand•

Use this Wire Rope on your toughest mining job—it's made to meet your needs!

Wherever you use Wire Rope—for scraper loaders, mine hoists, draglines, strip shovels, on mining machinery—you'll find MONARCH WHYTE STRAND Ropes have the toughness and flexibility to give you longer heavy-duty service at lower cost. These Ropes are *designed* to serve well under the toughest going—built to fit *your* needs and service conditions.

MONARCH WHYTE STRAND wire ropes have all the quality features it takes to give you outstanding service. They are supplied PREformed and Internally Lubricated to resist abrasion, corrosion, and internal friction. These Macwhyte Mining Ropes are available in every wire rope classification.

Macwhyte makes a *thousand and one* types, sizes, and grades of WHYTE STRAND wire rope. This assures a right rope for every mining use and service condition. *Use WHYTE STRAND on your toughest jobs—and see for yourself!*

MACWHYTE MINING ROPE

MACWHYTE COMPANY, 2937 Fourteenth Avenue, Kenosha, Wisconsin

Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope Assemblies.

MILL DEPOTS:
New York 4, 35 Water Street
Pittsburgh 19, 704 Second Avenue
Chicago 6, 228 So. Desplaines Street
St. Paul 14, 2356 Hampden Avenue
Ft. Worth 1, P.O. Box 605
Portland 9, 1603 N.W. 14th Avenue
Seattle 4, 87 Halasta Street
San Francisco 7, 188 King Street
Los Angeles 21, 2035 Sacramento St.

Write for WHYTE STRAND Bulletin 5425

PQ SODIUM SILICATE SERVICE for ORE DRESSING

PRODUCTS Over 40 silicates (liquids, solids, hydrated and anhydrous powders). You'll get the right one for your particular ore.

USES Dispersing agent, depressant, surface conditioner; for metallic oxides as well as non-metallic minerals.

DELIVERIES FROM NINE PLANTS: Anderson, Ind.; Baltimore, Md.; Chester, Pa.; Gardenville, N. Y.; Jeffersonville, Ind.; Kansas City, Kans.; Rahway, N. J.; St. Louis, Mo.; Utica, Ill.

Consult with us about your silicate needs.

PQ SOLUBLE SILICATES
METSO DETERGENTS
PHILADELPHIA QUARTZ CO.
1831 — 125TH ANNIVERSARY — 1956
1135 Public Ledger Bldg., Phila. 6, Pa
TRADEMARKS REG. U.S. PAT. OFF

EAGLE LOG WASHERS for Washing Phosphate Rock too!

A number of southeastern rock phosphate producers report highly satisfactory performance from EAGLE LOG WASHERS. M. C. Boyle Phosphate Co., Centerville, Tenn., reports "we could not do the job without our Eagle Log Washer". New 48" washer, 24' or 30' long, handles up to 150 tons per hour . . . processes material up to 8" in dia. Sturdy tubular log shaft . . . replaceable corrugated paddles. For rock, ore, gravel the Eagle is outstanding for production, economy, low maintenance cost. Send for Catalog 55.

EXPERIENCE, PROGRESS, SERVICE, SINCE 1872
EAGLE IRON WORKS
282 HOLCOMB AVE., DES MOINES, IOWA

Asbestos *(Continued)*

toward the objective of a mill capacity of 600 metric tpd. Program has been effected and extraction from 600 tpd rock is yielding between 6½ and 7% of Amveco "A" and "B" fibers, the first corresponding to a high 3 Group, the latter to a 3Z Canadian. Both grades are in strong demand for the asbestos-cement industry particularly in South America, Europe and Asia. Fiber is extremely clean, dust-free, strong, uniformly graded, with a superior drainage rate and sufficiently lower in iron than the Thetford to qualify under the Navy No. 3 specification for U. S. Government stockpiling.

All production is now coming from Montañita where the pit started into the side of the mountain from road level two years ago now has a series of five benches totalling some 200 ft in vertical height with a face length of 400 ft. Continued exploration and development at Montañita, Casupo and Casupito now envision an ore-reserve objective of 50-million tons, according to company officials.

At the El Tigre mill a raw-ore bin has been installed before the primary jaw-crusher, a Pioneer "Buzzer" screen replaces the outmoded shaker ahead of the Symons cone; belt conveyors have replaced all elevators and a 6x60-ft horizontal rotary dryer the former tower. A second Pioneer screen has been installed ahead of the Kennedy-Van Saun reduction crusher. The greatest proportion of the fiber produced is raised by suction from two Rotex screens in parallel which takes the split product from the K-VS crusher. Oversize rock then goes to two jumbos in parallel, followed again by Rotex screens. Some 16 Rotex screens in all are installed for primary circuit and cleaning of fiber. A fiberizer has been installed and Johnson's-type graders are used.

It is now proposed to add a 4th, 5th, 6th and 7th group fiber to the production schedule. Warehousing facilities have been acquired at Puerto Cabello with which Tinaquillo is connected by paved highway; manager's residence, additions to staff house and other ancillary construction have been completed. Mining and trucking of ore to mill is done under contract.

Another major development of 1955 comprised the initiating of production in the Temeraire mill of Rhodesian Asbestos Ltd. Project is under direction of Johns-Manville in association with British Metals Corp., Ltd., Anglo-Huronian Ltd., Southern Minerals and Marketing Corp. and the Simon Patino interests. Two mines are served by the mill, one at Shamala the other at Mashaba, 4 miles distant, in the Victoria District of Southern Rhodesia. As reported in "Asbestos" a steel and concrete shaft with a capacity of 200 tons an hour has been sunk 560 ft at the Temeraire mine at Mashaba and another with 100-tpd capacity to a depth of 520 ft at Shamala. Haulage to mill is by 15-ton diesel trucks. Mining uses blast-hole drilling methods and scram drifts, the ore being loaded directly into cars by 60 hp scrapers whence it is crushed underground by 42x48-in. jaw crushers. Mines are among the most highly mechanized in Southern Rhodesia. The mill has a capacity of 125 tons of ore per hour and is preceded by 8,000 tons of dry-rock storage. Fiber is all of the chrysotile variety and is produced largely in the asbestos-cement grades.

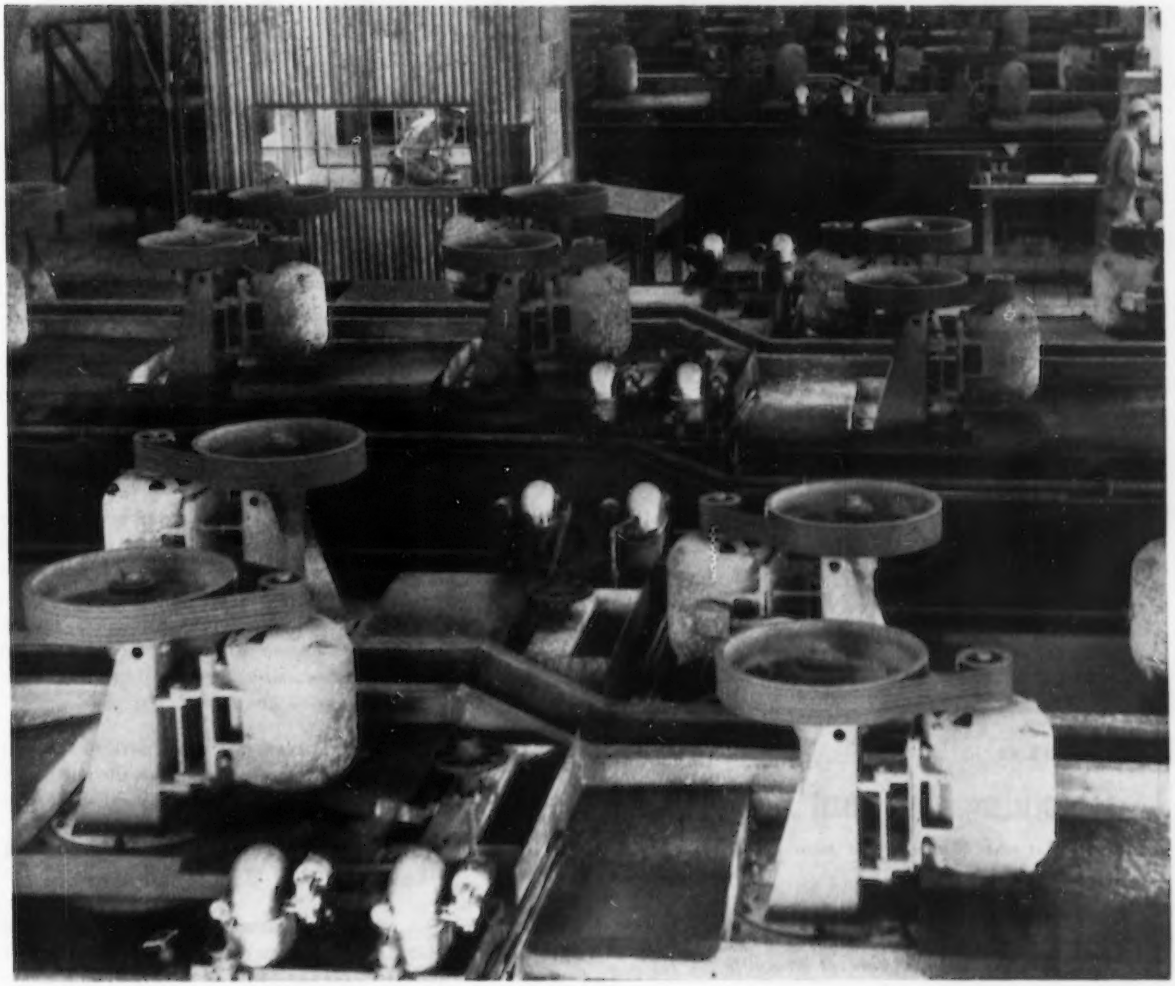
Although the Temeraire project does not as yet rival the Shabanie development of Turner-Newall, it has important significance since the sale of the output seems assured to the parent company. Rhodesia's output has been thus raised to over 9,000 tons of fiber per month; say, 110,000 tons annually.

Australian production is still struggling to compete with imported crocidolite and chrysotile. Combined output is still about 4,000 tons a year. Finland has raised slightly its output of amphibole. Morocco is still producing under 1,000 tons of chrysotile annually. Yugoslavia is steadily increasing its comparatively small though important output. The other and more important producers seem to have stabilized production in the following order: South Africa (chrysotile, crocidolite and amosite), 150,000 tons; United States (chrysotile and anthophyllite), 60,000 tons; Italy and elsewhere in Europe, 45,000 tons; Switzerland, (all chrysotile), 40,000 tons and Cyprus, 30,000 tons. Thus the Free World's asbestos production must now be about 1,750,000 tons.

This tonnage, combined with the large offerings from the USSR and coupled with the significant increases to Canadian mill capacity still projected on large, proven orebodies, seems to indicate that the supply of asbestos in all grades has finally caught up with present demand. In some grades (the textile, for example) output has exceeded 1956 manufacturing requirements. Unless increased usages for the longer fibers are found, the industry may find itself out of balance if the seemingly ever-increasing demand for shorts is to be fulfilled. However, the continued prosperity of the industry for the foreseeable future seems assured•

Again! CLARKSON REAGENT FEEDERS

chosen for new copper concentrator in Arizona



All copper concentrators in the Southwest use Clarkson Feeders. More than 9,000 Clarkson Model E, 18-8 stainless steel feeders are serving in the flotation operations of all mining districts. Precision, dependability and 7 to 10 year operation without maintenance accounts for this preference. A special Clarkson in PVC rigid plastic solves the tough problem of feeding acids and solutions such as copper sulphate.

Write for Bulletin 540 and 541 for complete specifications.

THE CLARKSON COMPANY
A Division of Equipment Engineers Inc.,
manufacturers of Krebs Cyclones and Krebs Valves

564 MARKET STREET • SAN FRANCISCO 4, CALIFORNIA

Since 1908...

DIAMOND DRILL BITS

choose the **RIGHT MATRIX HARDNESS for YOUR JOB!**

for exploration and prospecting.

- ASCOLITE bits . . 55 to 60° hardness
- NICOLITE bits . . 40 to 45° hardness
- BRONZOLITE bits . . 18 to 24° hardness on Rockwell "C" scale

POWDERED METAL

Special tungsten alloy powdered metal matrix to meet all drilling conditions. Bit crowns *sintered* onto blank bits in one operation.

Drill bortz and cast in all sizes and prices. Brazilian ballas and carbons. ASCOLITE reaming shells, etcetera.

Price catalog on request

ANTON Smit & CO. INC.

111 Eighth Ave., New York 11

Cables: PROFITABLE, New York

EST'D 1908

If there is

something you want . . .

that other readers of this paper can supply

or —

something you don't want . . .

that other readers can use, advertise it in the

SEARCHLIGHT SECTION

(Classified Columns)
of this paper

BALL MILL-CLASSIFIER

GRIND AND CLASSIFY IN A COMPACT SINGLE UNIT, EFFICIENTLY, TO ANY SIZE, IN ONE EASY STEP. NO PUMPS, NO LAUNDERS—COMPLETELY AUTOMATIC.

OTHER AWFCO MACHINES: • GY-ROLL REDUCTION CRUSHER • WAVE-IMPACT JAW CRUSHER • GYRATORY BALL MILL • VIBE-ROTATOR SIEVE SHAKER • FLOTATION MACHINES

AWFCO A. W. FAHRENWALD CO. E. 3500 RIV., SPOKANE, WASH. PRODUCTS OF RESEARCH

he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it"—"they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

McGRAW-HILL PUBLICATIONS

Who's handling public relations for you behind the Iron Curtain?

It's not an easy assignment—or the kind you'll find many people volunteering for.

But there *is* an important "public relations" job to be done behind the Iron Curtain—for you . . . for America . . . for the whole concept of freedom, free enterprise and individual rights. This job is an opportunity and a challenge as well as a serious responsibility for American business. Fortunately, with your help, there *is* an agency that can do the job—*Crusade for Freedom*, which supports Radio Free Europe and Free Europe Press.

Both these powerful, privately operated organizations continually challenge the barrage of Communist misstatements and false truths. Using saturation radio broadcasts and mass newspaper drops from message balloons, Radio Free Europe and Free Europe Press are constantly on the offensive against the Red campaign to annihilate right, reason and national pride.

Continued and heated Communist protests testify to the tremendous effectiveness of Radio Free Europe and Free Europe Press. Support freely given by free American business and private citizens will increase this effectiveness and the scope of their operations. A contribution now is perhaps the best investment you can make towards a peaceful, prosperous world.

Give generously. It's your future!

Check list for business executives in the Crusade for Freedom

- ☐ Order display material for your company bulletin board.
- ☐ Plan a paycheck stuffer to fully acquaint your employees with the importance of the Crusade for Freedom.
- ☐ Plan to conduct an in-company solicitation.
- ☐ Match employee funds with your *Truth Dollars*.

PUBLIC SERVICE ADVERTISING COUNCIL

For campaign material and information write **CRUSADE FOR FREEDOM,** 345 East 46th St., N. Y. C. 17.

Professional Services

ASSAYING
CONSULTING
PROSPECTING
ORE TESTING

RESEARCH
METALLURGY
MILL DESIGN
MINE MANAGEMENT

AGENCE MINIERE & MARITIME S.A.
Sworn weighers, samplers & Assayers of Ores, Metals. Representatives of shippers at European ports & Works. *Market surveyors and commercial advisers assuring sales direct to consumers*
2, rue Van Bree, Antwerp, (Belgium)

CALL IN A SPECIALIST TO SOLVE THAT PROBLEM

Experiment takes time—so why not save time by calling in a specialist who has already gone over the ground you are now exploring?
Engineering & Mining Journal, meeting place of mining men in all parts of the country, points the way to the solution of many milling problems through its Professional Service Section.
Why not tell one of these specialists about YOUR problems?

BEHRE DOLBEAR & COMPANY
Consulting Mining Engineers and Geologists
11 Broadway, New York 4, N. Y.

HERON ENGINEERING CO.
Consulting Engineers for all types of Aerial Tramways, Cableways, and Suspension Structures
200 South Acoma St.
Denver 19, Colorado

ROBERT S. MAYO
Civil Engineer
Complete Equipment for Concrete Lining of Tunnels, Haulageways and Shafts, Special Equipment for Underground or Subaqueous Construction.
Lancaster, Penna.

SMITH-EMERY CO.
Assayers and Chemists
SPECTROGRAPHIC ANALYSES
781 E. Washington Blvd.
Los Angeles 21, Calif.

BLANDFORD C. BURGESS
Consulting Engineer
Industrial Mineral Specialist
USOM, APO 928
San Francisco, Calif.
Manila, Philippines Monticello, Ga.

HOPKINS EXPLORATION CONSULTANTS
607-320 Bay St.
Toronto 1, Canada
EM 4-5642, HU 9-8375

ARNOLD H. MILLER
Consulting Engineer
General Mine, Mill and Industrial Appraisals
Plant Design, Mechanization and Improvement
Cable: "ALMIL," Tel. Cortland 7-0635
120 Broadway, New York 5

STILL & STILL
Consulting Mining Engineers and Geologists
24 Union Block — Phone 658
P.O.Box 1512
Prescott, Arizona

COWIN & COMPANY, INC.
Mining Engineers & Contractors
Shaft & Slope Sinking
Mine Development
Mine Plant Construction
1—18th Street S.W. Birmingham, Ala.
Phone 56-5566

KIRK & COWIN
Ralph E. Kirk Percy G. Cowin
Registered Professional Engineers
1—18th Street SW
Birmingham, Alabama
Phone 56-5566

ARTHUR NOTMAN
Consulting Mining Engineer
55 Liberty St., 18th Floor
New York 5, N. Y., U.S.A.
Telephone BArclay 7-9484

H. L. TALBOT
Consulting Metallurgical Engineer
Extraction and Refining of Base Metals
Specializing in Cobalt and Copper
Room 330, 84 State St.
Boston 9, Mass.

DICKINSON LABORATORIES
Assayers—Chemists—Metallurgists—Umpire Work
Ore Shippers representatives at Local Plants
Samplers - Analysts at Mexican Border Points
1300 West Main St. El Paso, Texas

KELLOGG KREBS
Metallurgical Engineer
Mineral Dressing Consultant
564 Market St. Telephone:
San Francisco 4, Calif. SUtter 1-6613

RODGERS PEALE
Consulting Mining Geologists
315 Montgomery Street
San Francisco 4, Calif.

TECHNICAL LITERATURE SURVEY SERVICE
Exploratory literature searches
Bibliographies
Data Searches
Technical Reports
Current Literature Surveys
P. O. Box 1766, Baton Rouge, La.

ABBOT A. HANKS, INC.
ASSAYERS—CHEMISTS
Est. 1866
Spectrographic Analysts
Shippers Representative
624 Sacramento Street
San Francisco 11

LAKEFIELD RESEARCH LIMITED
Metallurgical and Chemical Research
Ore Testing
Analysis and Assaying
Box 430 Phone 7
Lakefield, Ontario, Canada

AMEDEE A. PEUGNET
Consulting Mining Engineer
Telephone MAin 1-1431
705 Chestnut St., St. Louis 1, Mo.

GODFREY B. WALKER
Metallurgical Consultant
Mineral Dressing, Extractive Metallurgy
Heavy Media a Specialty
37 Lockwood Drive
Old Greenwich, Conn.

JOSEPH H. HEDGES
Consulting Mining Engineer
4809 De Russey Parkway
Chevy Chase, Washington 15, D.C.
Phone OLiver 4-6406

LEDOUX & COMPANY, Inc.
Metallurgical Chemists — Assayers
Spectroscopists
Representatives of Shippers of Ores and metals at Buyers Works
Mine Examination Analyses
359 Alfred Ave., Teaneck, N. J.

ROGER V. PIERCE
Consulting Mining Engineer
808 Newhouse Building,
Salt Lake City, Utah
Telephone — Empire 3-3973

HARRY J. WOLF
Mining and Consulting Engineer
Examinations — Valuations — Management
One Park Place
New York 7, N. Y.
Cable: MINEWOLF
REctor 2-5307

E. LEE HEIDENREICH, JR.
Consulting Engineers
Crushing Plants Quarries
Milling Plants Plant Design
Plant Layouts Appraisals
75 Second St., Newburgh, N. Y.
9 So. Clinton St., Chicago 6, Ill.

E. J. LONGYEAR COMPANY
Geological and Mining Consultants
Exploration and appraisals of metallic and non-metallic mineral deposits
Photogeology
Foshay Tower Minneapolis, Minn.

LUCIUS PITKIN INC.
Mineralogists—Assayers Chemists—Spectroscopists
SHIPPERS REPRESENTATIVES
Main Office—Laboratories
Pitkin Bldg.—47 Fulton St.
New York 38, N. Y.

WORLD MINING CONSULTANTS, INC.
Consulting Mining Engineers and Geologists
220 Broadway, New York 38, N. Y.
WOrth 2-2934

Because the consultant gives an "outside viewpoint" and is free of the traditions and inhibitions which ofttimes hamper the thinking of the men on the job, he is frequently able to see more clearly and offer valuable advice.
Let him join your staff and demonstrate the practical dollars-and-cents value of an outside viewpoint.

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED ——RATES—— **UNDISPLAYED**

The advertising rate is $16.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—8 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to ENGINEERING & MINING JOURNAL, 330 W. 42nd St., N. Y. 36, N. Y. for March issue closing February 21st

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

U. S. company operating in Central America has opening for Assistant Mill Superintendent qualified for possible promotion to mill superintendent's position who will be in direct charge routine operation, maintenance, major repairs, rehabilitation of equipment and structures, and such new construction as may be required. Assisted by full crew of foreign supervisors and day's pay crew. Mill treats a gold-copper ore by straight cyanidation, requiring close metallurgical control. Standard flowsheet procedures lead to final smelting of precipitate to produce a gold-silver bullion. Operating and maintenance of prime importance. Cyanidation experience preferred, but not essential provided man has adequate experience in crushing, ball milling, material handling and general maintenance of equipment and structures. Knowledge of Spanish helpful, but not required. Applicant must be adapted to living in tropical mining camp. Experience in such camps preferable but not necessary. Adequate housing for married man furnished by company, plus living allowance. P-9139, Engineering & Mining Journal.

U. S. Company operating in Central America has opening for Engineer capable routine mine surveying and assist Chief Engineer in checking native transitmen and samplers. Two year contract. B.S. beginner or experience equivalent. Knowledge Spanish helpful but not essential. Married man preferred. Well established camp with adequate facilities for dependents. P-9145, Engineering & Mining Journal.

Assistant to Chief Metallurgist—South American Mining Concern—5-7 years experience ore dressing selective flotation-hydrometallurgy (copper)—preferably graduate chemical engineer headquarters Peru—periodic travelling high altitude mines—send letter stating qualifications, references, salary desired to P-9155, Engineering & Mining Journal. Replies strictly confidential.

To EMPLOYERS
Who Advertise
For MEN:

Frequently, when there are many applicants for a position, only the most promising letters are acknowledged. The other applicants never know whether their letters reached a prospective employer or not. These men often become discouraged, will not respond to future advertisements and even question their bona fide character.

Every Advertisement Printed in the Searchlight Section Is Duly Authorized. You can help keep our readers interested and get better returns to your advertising in this section if you acknowledge each reply—in plain envelopes, if you wish.

Classified Advertising Division

McGRAW-HILL PUBLISHING CO., INC.

"Put Yourself in his place."

PROJECT ENGINEER WANTED

Graduate Mining, Metallurgical, Chemical or Mechanical Engineer, preferably 25 to 35 years old, wanted by medium size progressive heavy machinery manufacturing company located in Southeastern Pennsylvania. To assist in design and preparing for market of various lines of equipment used in mineral dressing, heavy chemical, cement and rock products industries. Must have had engineering and field experience, and be willing to work on drafting board, travel and do field service. Opportunity also exists for a properly qualified individual, eventually to become a sales engineer. Salary open.

P-7533 Engineering & Mining Journal
330 W. 42nd St., New York 36, N. Y.

TECHNICAL MINING PERSONNEL

Nation wide recruitment through 54 offices of the National Ass'n of Personnel Consultants at no charge to the employer. The Pacific Northwest's leading employment firm.

ACME PERSONNEL SERVICE
P.O. Box 132, Dishman Branch, Spokane, Wash.

POSITIONS VACANT

(additional Positions Vacant ads on the following page)

Applications are invited for the position of Research Metallurgist at a large base metal mine in South West Africa. Applicant should have considerable experience in base metal flotation on research or flotation operation. Company offers three-year contract, transportation for self and family, and salary while traveling. House furnished with heavy furniture available for married man. Climate and living conditions excellent. Forward reply, giving age, education, experience record, references and marital status to: P-9146, Engineering & Mining Journal.

Junior Metallurgist, to perform control work and ore dressing research in a 5,000 ton magnetic-gravity-flotation mill. Excellent opportunity for recent graduate. Liberal housing policy and benefits. Location Northeast. Salary open. P-9008, Engineering & Mining Journal.

Ore dressing engineer and technicians to handle test work in commercial laboratory. Engineer to assist in plant design, cost estimation, and engineering controls. Age 25 to 35. Preferably B.S. mining degree. Excellent opportunity to grow with progressive organization. Salary commensurate with experience. Headquarters Florida. P-8875, Engineering & Mining Journal.

U. S. Mining Company operating in South America has opening for Assistant Mine Manager. Considerable underground experience and knowledge of Spanish essential. Fine potential for career-minded man with administrative abilities who has development possibilities for full management responsibilities. Immediate employment for customary three year contract period. Camp well established with adequate facilities for dependents. P-9010, Engineering & Mining Journal.

POSITIONS WANTED

Mining Metallurgical engineer with wide experience in process specification flowsheet design equipment selection plant layout construction and operation. Also mines examination and management now employed available late February. PW-9118, Engineering & Mining Journal.

Mining Engineer, 35, married, 6 years experience open pit mines. Employed. Desires position with future. PW-9167, Engineering & Mining Journal.

EQUIPMENT MANAGER

Required by transportation company headquarters in Whitehorse, Yukon Territory. Applicants must be graduate engineers mechanical, mining, metallurgical or civil between the ages of 40-45 years with at least ten years experience in the selection, operation, and repair of automotive, crawler and contractor's work equipment or mechanical equipment used in open pit mining operations and motor truck transport. Business administration experience desirable, but not essential. Married man preferred; housing available. State salary required and forward references on application along with recent photo and record of salary progression to date. Interviews will be arranged at suitable point if applicants justify.

P-8425—Engineering and Mining Journal
68 Post St., San Francisco 4, Calif.

MINING ENGINEER

Young, recent graduate, with one or two years' experience in underground engineering. Duties will be varied, including surface and underground surveying, calculation, mapping, drafting and other miscellaneous work for underground metal line. Location Southeast.

P9131 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

POSITIONS WANTED

Mineral Dressing Engineer, 30, B. Min. E., M.S. Met. 6 years exp. Examination on all types of ores including cost appraisal and plant design. Desires employment in research or plant controls. PW-9115, Engineering & Mining Journal.

Mining Engineer, E.M. degree, 20 years broad American and foreign experience in mine management, supervision, and engineering desires position of responsibility in continental United States. PW-9018, Engineering & Mining Journal.

Mining Engineer, graduate, age 48, 5 yrs. mining, employed last 10 years large mapping organization, wants permanent position general engineering or surveying surface mining this country. PW-8985, Engineering & Mining Journal.

Chief Engineer, 6 years with major aluminum producer's bauxite quarry operations in South America, managerial and consulting experience, mining graduate '37, multilingual. Previously engaged gold dredging, non-ferrous metallurgy, rock-wool manufacture. Available for foreign or Stateside assignment May '56. PW-8833, Engineering & Mining Journal.

Competent Mining Engineer—Geol. Engr. Age 35. Established in Rocky Mountain region. 6 years excellent background in Lead-Zinc mining industry, 1 year Uranium exploration industry. Seeks opportunity with an established consulting, management, industrial, or investment firm. PW-9166, Engineering & Mining Journal.

PART TIME WORK WANTED

Wanted—Contracts for exploration, construction, development or sales. New Era Mine, 1290 Birch, Denver 20, Colorado.

CHIEF GEOLOGIST

Exceptional opening in aggressive expanding mining operation for top flight geologist capable handling technical and executive duties. Position includes planning exploration, handling personnel, and coordinating operations closely with those of Mining Division. Both domestic and foreign explorations require highly adaptable individual, not averse to travel. For immediate confidential consideration, please give complete information on age, education, experience and salary required.

P9176 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

MINING ENGINEER

Excellent opportunity for engineer thoroughly experienced in open-pit mining methods and equipment. Prefer also some experience in underground operations. Position involves assisting mining executive in administrative responsibilities and requires man, age 33-40, capable advancing into executive capacity. We are interested in a man now employed in managerial or otherwise highly responsible mining work who aggressively desires and is capable of advancement not available in his present employment. In confidential reply, give age, education, experience, and salary required.

P9127 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

PROJECT ENGINEER WANTED

Major West Coast engineering firm offers outstanding opportunity to well qualified engineer with degree in metal mining, metallurgical or mechanical engineering—age 35 to 50.

Must have broad design and operation experience in basic industries such as cement, metal mining, ore dressing, smelting, metallurgical milling.

Please write furnishing complete chronological experience record and salary history. Also show details regarding education, salary desired, business and character references.

P8742 Engineering & Mining Journal
68 Post St., San Francisco 4, Calif.

STAFF ENGINEER

Recent graduate, preferably with a B.S. in Mining or Civil Engineering and one or two years' experience in the mining industry, to act as Staff Engineering Assistant to Manager of an open cut mining and ore dressing operation in Virginia. Salary $400 to $550.

P9123 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

MINING ENGINEERS

With at least one year's practical experience in underground copper or iron mining or milling and concentration wanted for new mining operations in Israel. State qualifications and salary desired.

P9136 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

MINING AND MILL SUPERINTENDENT

Age 30 to 45 with B.S. or Engineer of Mines degree in mining or ore dressing metallurgy with 6 to 10 years' experience as superintendent or assistant superintendent of a medium sized operation, to operate an open cut mining and gravity ore dressing operation in Virginia. Will also be responsible for payrolls,personnel, labor and internal office work on the operation. Salary $8,000 to $10,000 per year.

P9125 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

RATES

UNDISPLAYED

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED

The advertising rate is $13.80 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns 30 inches—to a page

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Send NEW ADVERTISEMENTS to N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y. for March Issue closing February 21st

BUSINESS OPPORTUNITY

An excellent write off, controlling interest in the Northern N. Y. Mining Corp. owner of proven zinc holdings near Balmat, St. Lawrence County, New York State Zinc presently under lease, talc open for development, C. Haile Sprague, Gouverneur, N. Y.

FOR SALE OR LEASE
COPPER-URANIUM CLAIMS

Located Pinal City, Ariz. Copper assays 2½%-35%; Uranium assays 0.30%. Great Reserves. Mining can begin immed. Close to RR siding, smelters. Engr. & Geol. report available. Write L. E. Arzt, 4312 N. 12th St., Phoenix, Arizona.

A.I.M.E. TRANSACTIONS

Wanted To Buy for Cash and other Technical, Scientific Periodicals.

Ashley, 27 E. 21, N.Y.C. (10)

SCIENCE, NATURAL HISTORY CAMP 30 BOYS AND GIRLS, 8-12 YEARS

Geology, botany, conservation, the sky, life on earth, in air or water. Swimming, riding, crafts, shop, farm, sports. Since 1939. Eight week season, $450.

GEORGE AND CARYL DILLMAN
Hackmatack Camp, Otis, Mass.

WANTED
JAW CRUSHER

48" x 60"

OR LARGER OR SMALLER

Producers Supply & Engineering Co.
4200 S. Lawndale Avenue, Lyons, Ill.
Phone: Lyons 3-4526

FOR SALE

One Used Tyler Hummer Electric Screen Type 38, 4' x 8', in very good condition with one Model 218-C Type Y-16 Power Converter 220 Volt, 60 cycle, Serial No. 1822-12.

GOUVERNEUR TALC CO., INC.
Gouverneur, New York

FOR SALE
HEAVY MEDIA MILL

At Brownsville, Texas, complete with crushers, screens, conveyors, etc.

FS 9157 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

FOR SALE

25—Sanford-Day 1-2-3 drop bottom cars, all steel construction, 36" track gauge, 40" high from rail, 5 ton capacity, sacrifice price.

Montana Coal & Iron Co.
Red Lodge, Montana

Your inquiry will have Special value . . .

If you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertiser wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

GOOD USED REBUILT MACHINERY

BLOWERS
1—Jeff. Universal type mine ventilator with 5 HP motor
1—Jeff. 11½ intake, 9½ disch. with 2 HP ind. motor
1—Joy axivane, series 1-21 with 5 HP motor
1—Coppus Ventair, TM-6
1—Coppus Vano SP-175, new 12″ beaded diffuser
1—Coppus Ventair Model T-5
1—New Coppus Vano—8″ dia. beaded outlet
1—American Sirocco, 3-P
1—Victor Acme positive displacement, size 24

BITS
Portland Throwaways — 1-9/16″, 1-5/8″, 1-11/16″, 1-7/8″, 2″
Liddicoat 2H and 2L — 1-1/2″, 1-9/16″, 1-5/8″, 1-11/16″, 1-3/4″, 1-13/16″, 1-7/8″, 1-15/16″

AMALGAMATION BARREL
1—Joshua Hendy 18″ dia. x 24″ long with ¾ HP Master Gearmotor, 48 rpm, 220/440 volt

CARS, MINE
19—Ajax Coeur d'Alene 32 cu. ft. 18″ ga., side dump
57—14 cu. ft. 18″ ga. swivel end dump type
6—20 cu. ft. swivel type end, 18″ gauge, roller bearing
1—14 cu. ft. mine car, roller bearings, 20″ ga. timber truck
7—18.8 cu. ft. new Coeur d'Alene end dump, Timken bearing

CLASSIFIERS, RAKE
1—6′ x 25′ Dorr duplex
4—4′6″ x 18′ duplex reciprocating rake
1—6′ x 19′6″ type 6, Dorr duplex rake
11—6′ x 27′ Dorr duplex rake
1—6′ x 20′ Eimco duplex rake
1—8′ x 26′ Denver duplex rake
1—6′ x 26′8″ Dorr duplex rake Model DSFH

CLASSIFIERS, SPIRAL
1—48″ x 18′ spiral (Akins type)
1—24″ x 10′ spiral, Simplex, double pitch
1—24″ x 16′ Denver crossflow

CLASSIFIERS, BOWL
2—6′ x 26′8″ x 12 dia., Dorr Model DSFB

CONVEYORS
1—36″ x 121′ centers, bridge type steel frame
1—20″ x 54′ antifriction centers
1—18″ x 32′ centers
1—18″ x 25′ centers, steel frame
1—18″ x 25′ centers
1—16″ x 24′ centers
1—30″ x 21′ centers
1—16″ x 12′ center, steel frame

CRUSHERS
1—28 x 36 Traylor Blake type
1—10 x 21 Telsmith roller bearing
1—9 x 16 Eimco
1—8 x 15 Tuttle Mfg. Supply
1—8 x 12 Risdon Blake
1—8 x 10 Denver Eng. Co.
1—3′ Symons shorthead
1—1′8″ Reduction Traylor type TY
1—4′ Symons
1—28″ Telsmith Intercone

ELEVATORS
1—Belt, bucket 25′ centers, 8″ by 5½ buckets

FEEDERS
4—30″ x 5 S.A. apron type
1—Ore 18″ x 7′6″ reciprocating plate
1—Lime, eccentric type with storage bin
1—Grizzley, small steel frame 24″ x 30″ x 1¾″
2—3′ wide x 6′9″ centers apron type, mounted on I beams and channel iron base

FILTERS
1—8′ x 6′ Portland drum
1—8′ x 4′ Oliver drum
1—4′ 2-leaf Eimco
1—4′ single-leaf Eimco
1—4′ 4-leaf American
2—6′ 2-leaf American

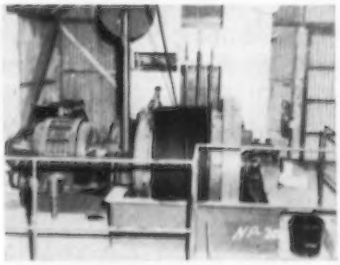
FLOTATION UNITS
1—#24 4-cell Denver rougher
2—No. 18 Denver 8-cell with four 5 HP ind. motors, equipped with wood cells

MOTOR GENERATOR SETS
2—50 KW D.C. Allis Chalmers 250 v. with 75 HP West. ind. motor

DIESEL GENERATOR PLANTS
1—300 KW 450 volt, 3 phase, 60 cycle, GM8, 268A Eng.
1—220 KW 440 volt, 3 phase, 60 cycle, with two Model D-13,000 Cat. Eng.
2—112½ KVA skid mounted, 220/440 volt, D-17,000 Eng.
2—50 KW 240 volt, AC with International Model UD-18, full

GENERATOR SETS, GAS DRIVEN
1—10 KW Kohler gas. powered elec. plant with Kohler generator

HOISTS, SHAFT



1—100 HP single drum Taylor Fdry and Eng.
1—Vulcan 125 HP single drum
1—Vulcan 150 HP single drum
1—Ottumwa 600 HP single drum

HOISTS, SLUSHER AND TUGGER
2—25NNN3D I. R. electric three-drum
1—HEE G. D. air two-drum
1—7 NN1J Electric, two-drum
1—S211 Joy air, two-drum
2—20NM2D I. R. electric two-drum
1—CF211 60 HP Sullivan two drum
2—HA-3 Sullivan, single drum
1—E112 Sullivan, single drum

JIGS, MINERAL
1—8 x 12 Denver Simplex

LOCOMOTIVES, BATTERY
4—Locomotives, Mancha-Titan AN18-24″ ga., 3½ ton
1—3 ton Greensburg 24″ gauge
2—Mancha "Little Trammers"
1—Whitcomb 3½ ton 24″ gauge
1—5 ton trolley locomotive, Goodman 42″ gauge
1—10 ton Plymouth diesel

MILLS, BALL AND ROD
23—Marcy 86 (8 x 6)
4—Marcy 96 (9 x 6)
2—8 x 36 Hardinge ball
1—7 x 36 Hardinge ball
1—6 x 6 Hendy
1—6 x 4½ Marcy
1—6 x 22 Hardinge
1—6 x 16 Hardinge
1—5 x 5 Marcy
2—5 x 14 Allis Chalmers ball
4—5 x 14 Marcy ball
2—5 x 10 Allis Chalmers rod
1—5 x 5 Marcy ball
1—4½ x 16 Hardinge
1—4 x 4 Denver

MUCKERS
4—G.D.-9 Gardner Denver 18″ ga. rebuilt

PULVERIZERS
1—Braun UA Lab.
1—Iler 6″ lab. with motor

PUMPS, SAND
3—2″ (new) Allen Sherman Hoff Hydroseal type A
1—4″ Allen Sherman Hoff Hydroseal, vertical
2—1½″ Denver
1—Kimball Krogh, 1½″

SCREENS
2—2′ x 4′ Selectro single-deck vibrating with 1½ HP motor
1—Symons 'F' 3 x 10
1—Symons 'F' 3 x 8

SIEVE SHAKER
1—Braun sand for 8″ dia. sieves
1—Tyler Ro-Tap

THICKENERS
2—40′ x 10′ Eimco mechanisms
2—20′ x 8′ Dorr, with wood tanks
1—12′ x 8′ Denver, with wood tank
1—10 x 6 with steel tank

WEIGHTOMETER
1—Merrick Model E for 18″ conveyor

WRITE, PHONE, OR WIRE FOR FURTHER INFORMATION

MACHINERY CENTER, INC.

808 NEWHOUSE BUILDING, SALT LAKE CITY, UTAH

PHONE EM 33973

RELAYING RAIL
All Sizes
Track Accessories
LEFTON INDUSTRIAL CORP.
Genl. Office: 212 Victor St.
St. Louis 4, Mo.

---

(2) Flory Double Drum
Duty 9500# @ 250 FPM
Total load on drum, 18,500#
(2) drums 8′ dia. x 5′6″ face, grooved 1½″
(1) drum clutched. Dead weight brake
Overspeed and overwind devices
Indicator. Post brakes
Motor and control will be furnished to meet customers requirements.
BERRETTINI ELECTRIC CO.
360 N. Main St., Plains, Pa.

LIDGERWOOD HOIST

Serial #8001. 250 H.P. 2300 volt slip ring motor drive Hoist designed for 350 f.p.m. of 1 7/8″ rope. Face of drum 55 9/16″, diameter to bottom of groves, 84″ Electric brake connected. Split drum, all steel base, Blue prints available.

2000 KVA G.E. type H. T. Form D.H. 66,000/22000/2300/60 cycle Serial #45-40898

ELJAY INC.
L. J. Land, Pres.
401 Broadway, New York 13, N. Y.
Telephone Worth 6-0969

FOR SALE

Hardinge Conical Steel Ball Mill, 6′ dia. x 22″ long.
Allis Chalmers Ball Mill, 6′ D x 16′ L
Rotary Dryers and Kilns: 3′ D x 24′; 4′6″ D x 40′; 5′ D x 30′; 10′6″ D x 105′
Bird Continuous Centrifuges, 36″ x 50″ and 24″ x 24″
Ing. Rand Centrifugal Pump, #10-ALV, 3000 GPM—200′. UNUSED.

PERRY EQUIPMENT CORP.
1419 N. 6th St. Phila 22, Pa.
STevenson 4-7210

When You Need
LOW COST—DEPENDABLE
INDUSTRIAL RUBBER PRODUCTS

call CARLYLE

FOR ALL YOUR REQUIREMENTS OF

RUBBER HOSE

Air, Acid, Paint Spray, Solvent Welding, Pile Driver, Discharge Fire, Fuel Oil, Oil Suction & Discharge, Gasoline, Suction Water Steam, Vacuum Pneumatic Road Builders

BELTING

Conveyor Elevator, Grader Chute Lining, Hot Material Mucker, V-Belts Transmission

PROMPT SHIPMENTS LOW COST QUALITY PRODUCTS

CARLYLE RUBBER CO., INC.
103-107 Warren St., New York 7, N. Y. Digby9-3810

COMPRESSOR: Chicago Pneumatic 23 x 13 x 16 with 300 H.P. Synchro motor, 2200 volt.

SLUSHER HOIST: Ingersoll Rand 50-MNM4C, 3 drum, 50 H.P., 220/440 volt. Also, one 15 H.P., 2 drum.

TUBE MILL: Allis Chalmers 5' x 22 ft. with steel heads.

PAN CONVEYOR: 48" x 110 ft., 100 H.P. motor, 440 volt, with speed reducer and drive.

PAN FEEDERS: Heavy duty manganese 60" x 13 ft., 20 H.P. motor, 220/440 volt, with speed reducer and drive. New condition. Link Belt 36" x 10 ft. with motor and reducer.

CRANES: P & H 855, 90 ft. boom, G.M. diesel. Lorain model 820 Crane and Shovel, 90 ft. boom, Cat. diesel.

JAW CRUSHERS: 48 x 60", 42 x 48", 40 x 42", 36 x 48", 30 x 42", 24 x 36", 18 x 36", 10 x 20", offered with or without motors.

DRYERS: 2—Ruggles Coles XAI8, 104" x 70 ft., double shell, with 60 H.P. motor, speed reducer, exhauster, etc., suitable for use as kilns. Available 90 days. Condition like new.
1—6' x 60' and one 5' x 30' complete with all auxiliary equipment.

REDUCTION CRUSHER: Symons 2 ft. standard bowl.

SCREENS: Tyrock 5' x 12', single deck, type F600. Allis Chalmers 4' x 12', single deck, low head.

LOCOMOTIVE CRANE: 25 ton capacity, standard gauge, gasoline powered, cast steel trucks, air brakes, with or without 1½ yd. Williams clam shell bucket, thoroughly modern, excellent condition. Located Minnesota. For sale or rent.

TRUCK CRANES: Lorain model TL20 with shovel backhoe and crane boom. Northwest model 25 with 50 ft. boom.

MINE HOIST SPECIAL: Vulcan 650 H.P., double drums, 8' dia., 7'6" face, one drum clutched, 1⅝" rope, 1400 FPM, thoroughly modern, with control and safety devices.

MINE HOISTS: Single and double drum, 100 to 2500 H.P. with all electrical equipment. Complete specifications, drawings, photos, available.

HOIST MOTORS:
300 H.P., 435 RPM. 600 H.P., 710 RPM.
400 H.P., 588 RPM. 1200 H.P., 444 RPM.
2200 volt, A.C. with controls.

FLOTATION MILL complete with all auxiliary equipment and large quantity of spare parts. Thoroughly modern, condition like new.

WE BUY AND SELL EQUIPMENT THROUGHOUT NORTH AND CENTRAL AMERICA

A. J. O'NEILL
Lansdowne, Pa.
Phila. Phones: MAdison 3-8300 — 3-8301

LARGE DRAGLINE BARGAIN

625 Page Two Engine Walker, 160' boom; 9½ yd. all manganese bucket. Three years old. Right Price. We originally sold this machine, are well acquainted with it, and know it is in excellent condition. Pennsylvania location.

Write—Wire or Phone—

FRANK SWABB EQUIPMENT CO., INC.
313 Hazleton Nat'l. Bank Bldg.
Hazleton, Pa. GLadstone 5-3658

HERE IS AN OUTSTANDING BARGAIN IN A LARGE SINGLE DRUM SERVICE HOIST, located near Wallace, Idaho:

850 HP NORDBERG, FIRST MOTION, DIRECT CURRENT MOTOR DRIVEN WITH WARD-LEONARD CONTROL, 20,000# ROPE PULL, UP TO 1350 FEET/MINUTE ROPE SPEED, DRUM CAPACITY 3600 FT. OF 1⅜" ROPE. PRICE COMPLETE WITH 1050 HP, 3/60/-2300 MOTOR DRIVEN M.G. SET AND ALL 2300 MOTOR DRIVEN M.G. SET AND ALL ELECTRICAL AND MECHANICAL ACCESSORIES. $75,000.00

ALSO AVAILABLE at same property:
134 ft. 3 sheave Steel Headframe $66.00 (per ton in place)
1—Hardinge 8' x 36" Conical Ball Mill with 150 HP, 3/60/2300 slip ring motors $8000.00
2—Hardinge 8' x 26" Conical Ball Mills with 125 HP, 3/60/2300 synchronous motor ea. 7000.00
1—Traylor 10" x 20" Jaw Crusher 2400.00
2—Traylor Type T Finishing Crushers 2—6" x 34" openings ea. 2000.00
1—8' x 10' Oliver Drum Filter with oscillating agitator and motors 4000.00
And many other items of milling equipment.

FOR MAIN TUNNEL HAULAGE, DIESEL POWERED LOCOMOTIVES ARE UNBEATABLE. ASKS US FOR QUOTATIONS ON:

NEW "MISSOULA" 2½ TON DIESEL-HYDRAULIC LOCOMOTIVES, 18" OR 24" GAUGE. NEW PLYMOUTH "MINE-O-MOTIVE" DIESEL-HYDRAULIC LOCOMOTIVES, 5 TO 10 TON, 24" TO 56½" GAUGE.

MILLER MACHINERY COMPANY
Box 1496 Phone 9-2309
Missoula, Montana

COMPRESSOR DIRECTORY
World's Best Rebuilts

All Makes
Many Sizes
Electric Steam Gas Diesel
AIR
Air for Sale or Rent Since 1902
1 CFM to 5700 CFM
1 lb. to 3500 lbs.

American
AIR COMPRESSOR CORP
47th ST & 31st AVE. NORTH BERGEN N. J.
Telephone UNion 5-4848

DRILL SHARPENERS
For Sale

New, in original packing case, Model 1R—40, complete with shank and bit punch, shanking devices, dies, dollies, punch pins and various other parts. Priced at approximate half of present cost. Packed for export.

FS9065 Engineering & Mining Journal
330 W. 42 St., New York 36, N.Y.

ELECTRICAL
WIRE AND CABLE
—YOUR BEST SOURCE—
• for every industrial and power application
• Odd lengths—long and short—reasonably priced
One of the Largest Stocks in the Midwest
Let us quote on requirements—
send your inquiries
We'll also buy your Surplus
Branch Offices:
Houston— Walnut 3-4580
Los Angeles— ANgeles 3-5148
FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION
UNIVERSAL Wire and Cable Co.
2863 M N. Clybourn Ave. EAstgate 7-4777
Chicago 14, Ill. Code: UNIWIRE

SINCE 1898 DEPENDABLE RECONDITIONED MACHINERY

BATTERY LOCOMOTIVES

1—3½ ton Atlas 24" gauge
1—4 ton Westinghouse 24" gauge
1—4 ton Ironton, 36" gauge
2—6 ton General Electric
1—6 ton Mancha Trackmaster, 24" gauge
2—7 ton General Electric, 36" gauge, permissible
1—7 ton Atlas, 36"-48" gauge
2—8 ton General Electric, 36" gauge
2—8 ton Goodman, 36" gauge
3—8 ton Ironton, 24"-48" gauge
4—10 ton Atlas, 36" gauge

TROLLEY LOCOMOTIVES

1—4½ ton Goodman, 36" gauge
1—5 ton Jeffrey, 36" gauge
2—5 ton Jeffrey, 42" gauge
1—6 ton Goodman, 36" gauge
1—6 ton Goodman, 42" gauge
2—8 ton Goodman, 42" gauge
3—10 ton Jeffrey, 42" gauge
1—13 ton Goodman, 42" gauge
1—13 ton Jeffrey, 42" gauge
3—15 ton Jeffrey, 42" gauge

FILTERS

2—2' x 4' Morse drum filters
2—4' x 8' Elmco drum filters
1—6' x 3' diss American leaf filter
1—18" Morse round pattern filter press
1—36" Merrill triangular filter press
1—#12 Sweetland filter press

SLUSHER HOISTS

1—Joy 15 h.p. double drum slusher Model AF-212
1—Joy 15 h.p. double drum slusher Model AAF-212
1—Joy 10 h.p. 3 drum slusher
1—Sullivan 2 drum slusher Model HD-10-B, gas engine driven

HOISTS

1—10HP Vulcan #0 Single Drum
1—15 HP Box Single Drum
1—20 HP H&B Single Drum
1—22 HP Vulcan Single Drum #1½
1—30 HP Vulcan Double Drum
1—30 HP Vulcan Single Drum
1—37 HP Single Drum
2—52 HP Vulcan #4½ Single Drum
1—50 HP Fairbanks-Morse Single Drum
1—60 HP Vulcan #23 ELF Single Drum
4—100 HP Box Single Drum
1—112 HP Vulcan Single Drum
3—125 HP Ottumwa Single Drum
2—150 HP Vulcan Single Drum
1—375 HP Dillon-Box Single Drum
1—22 HP Vulcan #1½ Double Drum
1—15 HP Stine Single Drum Contractors' Type
1—25 HP domestic Two Drum Contractors' Type
1—40 HP Thomas Single Drum Contractors' Type
1—40 HP American 3 Drum
1—80 HP Thomas 3 Drum
1—80 HP Lidgerwood
1—80 HP Clyde 3 Drum

CRUSHERS

4—2¼" x 3½" New Morse Lab Jaw Crushers
4—4" x 6" New Morse Lab Jaw Crushers
1—9" x 15" Farrell Jaw Crusher
1—8" x 24" Rodgers Jaw Crusher
2—11" x 18" Universal Jaw Crushers
1—24" x 13" Farrell Jaw Crusher
1—10" x 16" Hercules Jaw Crusher
1—15" x 24" Universal Jaw Crusher
1—26" x 18" Williams Hammermill

COMPRESSORS

1—41 CFM Ingersoll-Rand
2—88CFM Ingersoll-Rand
1—179 CFM Ingersoll-Rand
1—360 CFM Gardner-Denver, model WBH, with 75 HP motor
1—447 CFM Ingersoll-Rand
1—637 CFM Sullivan
1—696 CFM Union
1—800 CFM Ingersoll-Rand
1—1418 CFM Ingersoll-Rand

PORTABLE COMPRESSORS

1—105 CFM Ingersoll-Rand, gas engine driven
1—105 CFM Worthington, gas engine driven
1—125 CFM Jaeger, gas engine driven
1—210 CFM Worthington, continental gas engine
1—230 CFM Gardner-Denver stationary, Buda gas engine
1—310 CFM Sullivan, Buda gas engine
1—310 CFM Gardner-Denver stationary, Buda gas engine

BALL AND ROD MILLS

1—4" x 4" Marcy Ball Mill
1—6' x 48" Hardinge Conical Ball Mill
1—6' x 22" Hardinge Conical Pebble Mill
1—3' x 6' Marcy Rod Mill

VENT PIPES

3300 ft.—16" galv. steel vent pipe, 16 ga.
1400 ft.—18" steel vent pipe, 12 ga.
3200 ft.—20" steel vent pipe, 14 ga.

BATTERY CHARGERS

98—12 volt battery chargers, 30 and 60 amp. driven by Briggs & Stratton 1 cyl. gas engines

RAIL

12# to 100# rail in stock

OUR LARGE AND COMPLETE SHOPS ARE EQUIPPED TO REBUILD ANY TYPE OF MINING AND ELECTRICAL EQUIPMENT AND TO OFFER PROMPT SHIPMENT ON GUARANTEED RECONDITIONED MACHINERY. COMPLETE MANUFACTURING FACILITIES ARE ALSO AVAILABLE.

MORSE BROS. MACHINERY COMPANY

2900 Brighton Blvd. P. O. Box 1708 Keystone 5261 DENVER, COLORADO

SPECIALS

2—New 6½' x 150' Kilns
1—#6 Williams Jumbo Hammer Mill
1—Complete Lime Hydrating Plant

KILNS

1—4½' x 40', 9' x 180'

DRYERS

4½' x 30', 8' x 125'
2½ x 20' Louisville Steam tube dryer

CRUSHERS

1—40"x42", 36"x42", 30"x36", 24"x36", 18"x36", 12"x24" Jaw Crushers
2—42" x 16" Allis-Chalmers Crushing Rolls
36"x16" rebuilt Sturtevant rolls
2—24" x 14" Rogers Iron Works Rolls
1—24" x 12" Farrell Bacon Crushing Rolls
1—No. 322 Allis-Chalmers Hydrocone Crusher 48" Telesmith Gyrosphere Crusher—28" Telesmith Intercone Crusher
1—6", 10", 16" and 20" McCully Superior Gyratory Crushers
No. 3 up to No. 12 Gyratory Crushers

BALL, ROD & TUBE MILLS

1—6' x 12',5½' x 10', 8' x 6' Ball Mills
2—5' x 16'; 1—4½' x 10', 6' x 12' Rod Mills
2—5½' x 20' Tube Mills
2—6' x 22' Combed Mills—6' x 22' Tube Mills
1—8' x 36' Hardinge Mill
3—3-Roll Bradley Hercules Mills, Direct Connected to 300 HP Motors

MISCELLANEOUS

1—14' and 6' Air Separators
1—6' x 4', 6' x 8' and 12' x 10' Oliver Filters
We make new dryers-kilns and dust collectors.

Esta oferta sujeta a compromisos previos

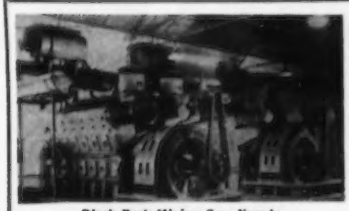
W. P. HEINEKEN, INC.

ENGINEERS & MFGRS.

50 BROAD STREET, NEW YORK 4, N. Y.

TEL. WHITEHALL 4-4236

Have you any machinery that you want to sell!



Black Rock Mining Co., Nevada

Benguet Mining Company, Philippine Islands

Elizalde Samar Mining, Philippine Islands

DIESEL POWER

STATIONARY
PORTABLE
MOBILE

New or Remanufactured

BUY AGSCO ENGINEERED DIESEL POWER

10 KW to 1500 KW
Continuous or
Standby Service

Let AGSCO Engineer Your Power Plant

A. G. SCHOONMAKER CO., INC.

Box 516, Sausalito, Cal. • 50 Church St., New York 7, N. Y.

ALPHABETICAL INDEX TO ADVERTISERS

(This index is published as a convenience to the reader. Every care is taken to make it accurate, but *E&MJ* assumes no responsibility for errors or omissions.)

Aerofall Mills, Inc. 181
Ainsworth & Sons, Inc., Wm. 221
Alemite Div. Stewart-Warner 207
Allen-Sherman-Hoff Pump Co. Second Cover
Allis-Chalmers Mfg. Co. (General Machinery) 60, 61, 153, 201
Allis-Chalmers Tractor Div. 10, 11, 217
American Air Filter Co., Inc. 222
American Brattice Cloth Corp. 232
American Cable Div. American Chain & Cable 233
American Cyanamid Co. Insert between pp. 50–51
American Forge Co. 188
American Hoist & Derrick Co. 260
American Steel & Wire Div. 64, 65, 183
Anaconda Wire & Cable Corp. 199
Armco Drainage & Metal Pdts., Inc. 214
Atlas Car & Mfg. Co. 248
Atlas Copco AB 160, 161
Atlas Powder Co. 219
Aurora Pump Div. New York Air Brake Co. 224
Autocar Div. White Motor Corp. 235

Baldwin-Lima-Hamilton Corp. (Construction Equipment Div.) 202
Bethlehem Steel Co. 12, 56, 190
Bixby-Zimmer Engrg. Co. 39
Booth Co., Inc. 216
Broderick & Bascom Rope Co. 239
Brunner & Lay, Inc. 186
Bucyrus-Erie Co. 162A, 169

Card Iron Works Co., C. S. 170
Caterpillar Tractor Co. 42, 157, 262
Chicago Pneumatic Tool Co. 20, 21
Christensen Diamond Pdts. Co. 172
Christian Engineers, J. D. 261
Clarkson Co. 251
Cleveland Worm & Gear Co. 59
Colorado Fuel & Iron Corp. 32
Colorado Iron Wks. sub. Mine & Smelter Supply Co. 26, 216
Columbia-Geneva Steel Div. 46, 64, 65, 183
Connellsville Mfg. & Mine Supply Co. 176
Crane Co. 50A
Crucible Steel Co. of America 34

Deister Concentrator Co. 195
Denver Equipment Co. 149
Detroit Diesel Engine Div. Gen. Mtrs. 167, 197
Differential Steel Car Co. 182
Dodge Mfg. Co. 231
Dorr-Oliver, Inc. 8, 9

Eagle Iron Works 250
Easton Car & Construction Co. 198
Eimco Corp. 22, 51, 245
Elektrokemisk, A. S. 184
Ensign-Bickford Co. 43
Euclid Div. Gen. Mtrs. Corp. 27
Exide Industrial Div. Electric Storage Battery Co. 177

Fahrenwald Co., A. W. 252
Fairchild Aerial Surveys, Inc. 221
Falk Corp. 38
Firestone Tire & Rubber Co. 215
Flexible Steel Lacing Co. 236
Ford Motor Co. (Trucks Div.) 54, 55

Gallgher Co. 36
Gardner-Denver Co. 41
Gates Rubber Co. 191
General American Transportation Corp. 50
General Electric Co. 14, 15
General Electric Co. (Loco. Div.) 195
Godoy & Co., Inc., E. A. 208
Goodrich Co., B. F. 5
Goodrich Co., B. F. (Tire & Equip. Div.) 229
Gould National Batteries, Inc. 223
Greensburg Machine Co. 184

Hardinge Co., Inc. 178
Harbinson-Walker Refractories Co. 18, 19
Haynes Stellite Co. Div. Union Carbide & Carbon Corp. 218
Hercules Powder Co. 227
Hoffman Bros. Drilling Co., Inc. 236
Hossfeld Mfg. Co. 248

Ingersoll-Rand 3
International Harvester Co. 24, 25
International Harvester Co. (Drott Mfg. Co.) 16, 17
International Nickel Co., Inc. 58

Jarrell-Ash Co. 261
Jeffrey Mfg. Co. 203
Jenkins Bros. 147
Johnson Co., C. A. 62, 63
Jones & Laughlin Steel Corp. 179
Joy Mfg. Co. 23, 212, 261

Kennedy-Van Saun Mfg. & Engrg. Corp. 151
Koehring Co. 62, 63

LeRoi Div. Westinghouse Air Brake Co. 246
LeTourneau-Westinghouse Co. 29, 31, 33
Link-Belt Co. 50B
Lippmann Engrg. Wks. 48, 49
Long Co. 243
Longyear Co., E. J. 187
Lubriplate Div. Fiske Bros. Ref. Corp. 240

Mace Co. 261
Macwhyte Co. 249
Mancha Storage Battery Div. Goodman Mfg. Co. 242
Manitowoc Engrg. Corp. 210
McLanahan & Stone Corp. 194
McNally Pittsburg Mfg. Corp. 193
Merrick Scale Mfg. Co. 224
Mine & Smelter Supply Co. 205
Minneapolis-Honeywell Regulator Co. 173
Morris Machine Works 166

Nagle Pumps, Inc. 232
Naylor Pipe Co. 228
New York Engrg. Co. 261
Nordberg Mfg. Co. 44, 45

Ohio Brass Co. 159
Ore & Chemical Corp. 171

Parsons Co. 62, 63
Pennsylvania Drilling Co. 261
Permutit Co. 52
Phelps Dodge Refining Corp. 180
Philadelphia Gear Works, Inc. 226
Philadelphia Quartz Co. 250
Pioneer Engrg. Works 247
Pittsburgh Lectromelt Furnace Corp. 28
Pittsburgh Steel Co. 174, 175

Quaker Rubber Div. H. K. Porter Co., Inc. 155

Radio Corp. of America 208
Reed-Curtis Nuclear Industries, Inc. 244
Ridge Tool Co. 193
Roebling Sons Corp., J. A. 209
Ryerson & Sons, Inc., J. T. 186

Searchlight Section 254–259
Simplex Wire & Cable Corp. 30
Simplicity Engrg. Co. 237
Smit & Co., Inc., Anton 252
Smit & Sons, Inc., J. K. 204
Smith Engrg. Works 185
Spang & Co. 168
Sprague & Henwood, Inc. 47
Standard Oil Co. of Calif. 189
Stephens-Adamson Mfg. Co. 238
Stoody Co. 163
Streeter-Amet Co. 193
Sturtevant Mill Co. 213

Taylor-Wharton Iron & Steel Co. 230
Tennessee Coal & Iron Div. 46, 64, 65, 183
Texas Co. 6, 7
Thermoid Co. 13
Thew Shovel Co. 234
Thor Power Tool Co. 57
Timken Roller Bearing Co. Fourth Cover, 53
Traylor Engrg. & Mfg. Co. 220
Twin Disc Clutch Co. 206

Union Oil Co. of Calif. 165
United States Rubber Co. (Mech. Goods Div.) 145
United States Steel Corp. 46, 64, 65, 183
United States Steel Export Co. 46, 64, 65, 183

Virginia Gear & Machine Corp. 226

Walworth Co. 241
Wedge-Wire Corp. 192
Western Machinery Corp. 225
Western Rock Bit Mfg. Co. 211
Wheel Trueing Tool Co. Third Cover
Wickwire Spencer Steel Div. Insert between pp. 162–163
Wilfley & Sons Co., A. R. 66

Yuba Mfg. Co. 164

PROFESSIONAL SERVICES 254

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 255, 256

BUSINESS OPPORTUNITIES
Offered 256

PROPERTY
For Sale 256

EQUIPMENT
(Used or Surplus New)
For Sale 256–259

WANTED
Equipment 256

ADVERTISERS INDEX

Acme Personnel Service 255
American Air Compressor Corp. 258
Arzt, L. E. 256
Ashley 256
Carlyle Rubber Co. 258
Berrettini Electric Co. 257
Dillman, George F. 256
Eljay, Inc. 257
Gouverneur Talc Co., Inc. 256
Heineken, Inc., W. P. 259
Lefton Industrial Co. 257
Machinery Center, Inc. 257
Miller Machinery Co. 258
Montana Coal & Iron Co. 256
Morse Bros. Machinery Co. 259
O'Neill, A. J. 258
Perry Equipment Corp. 257
Producers Supply & Engineering Co. 256
Schoonmaker Co., A. G. 259
Swabb Equipment Co., Inc., Frank 258
Universal Wire & Cable Co. 258

Smelting on Site

with

MACE Furnaces

and

Sintering Hearths

Saves high transportation and treatment charges on your ores and concentrates.

Wire or write for new catalog.

Standard sizes 5 to 250 tons capacity. Working scale tests on ton lots or larger made at our Denver smelter. Send us an analysis for preliminary report.

The Mace Company

FIRE CONCENTRATION METALLURGISTS

2763 Blake Street, Denver 5, Colo., U.S.A.

Analyze

URANIUM

in any form

in concentrations of 0.001% and less

JAco G-M *Fluorimeter*

Whether your problem is in research, production control, or ore assaying, you can make faster, more accurate analyses of uranium with the JAco G-M Fluorimeter. Leading mines, mills, metallurgical plants and laboratories all over the world report making 50 to 100 determinations a day — even when sample concentrations are 0.001% or lower.

The JAco G-M Fluorimeter offers you the high precision sensitivity and stability you want, because its advanced design includes exclusive features:

No Cooling System — Blacklight Blue lamps used as ultraviolet source require no cooling.
No Optical System — sample slide, light source and detecting system are mounted in close proximity eliminating optics and allowing low voltage across dynode of the photomultiplier tube.
Improved Power Source — circuit compensates for input-output voltage and tends to compensate for heater voltage variation.
Convenient Control Grouping — handy keyboard arrangement of switches and controls cuts time, reduces fatigue.

Write today for descriptive bulletin.

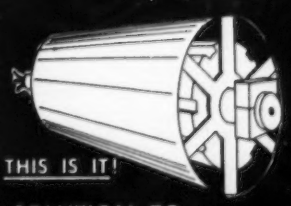
JAco JARRELL-ASH COMPANY

29 Farwell Street, Newtonville, Mass.

Branch Offices: Atlanta, Ga. Los Angeles (Duarte). New York, N.Y. Chicago, Ill. Muskegon, Mich. Palo Alto, Cal. Pittsburgh, Pa.

P·P·T

1-50 HP
12-60" BELT
A.C.-D.C.



THIS IS IT!

THE SOLUTION TO YOUR CONVEYOR DRIVES

MOTORIZED HEAD PULLEY DRIVE

J.D. CHRISTIAN • ENGINEERS

480 POTRERO AVE., SAN FRANCISCO 10

CORE DRILLING

—anywhere!

"We look into the Earth"

- Mineral Prospecting
- Foundation Test Borings and Grouting
- Large diameter holes for Ventilation and Escapeways

PENNSYLVANIA Drilling CO.

DRILLING CONTRACTORS & MFRS.

1205 Chartiers Ave. PITTSBURGH, PA. WAlnut 1-5816

CONTRACT CORE DRILLING

EXPLORATION FOR MINERAL DEPOSITS
INCLUDING URANIUM & LIMESTONE — ANYWHERE

FOUNDATION TEST BORING

GROUT HOLE DRILLING

Skilled crews and complete stock of core drills and accessory equipment maintained at all times

Core Drill Contractors for more than 60 years

JOY MANUFACTURING CO.
Contract Core Drill Division
MICHIGAN CITY, INDIANA

ALLUVIAL DEPOSITS

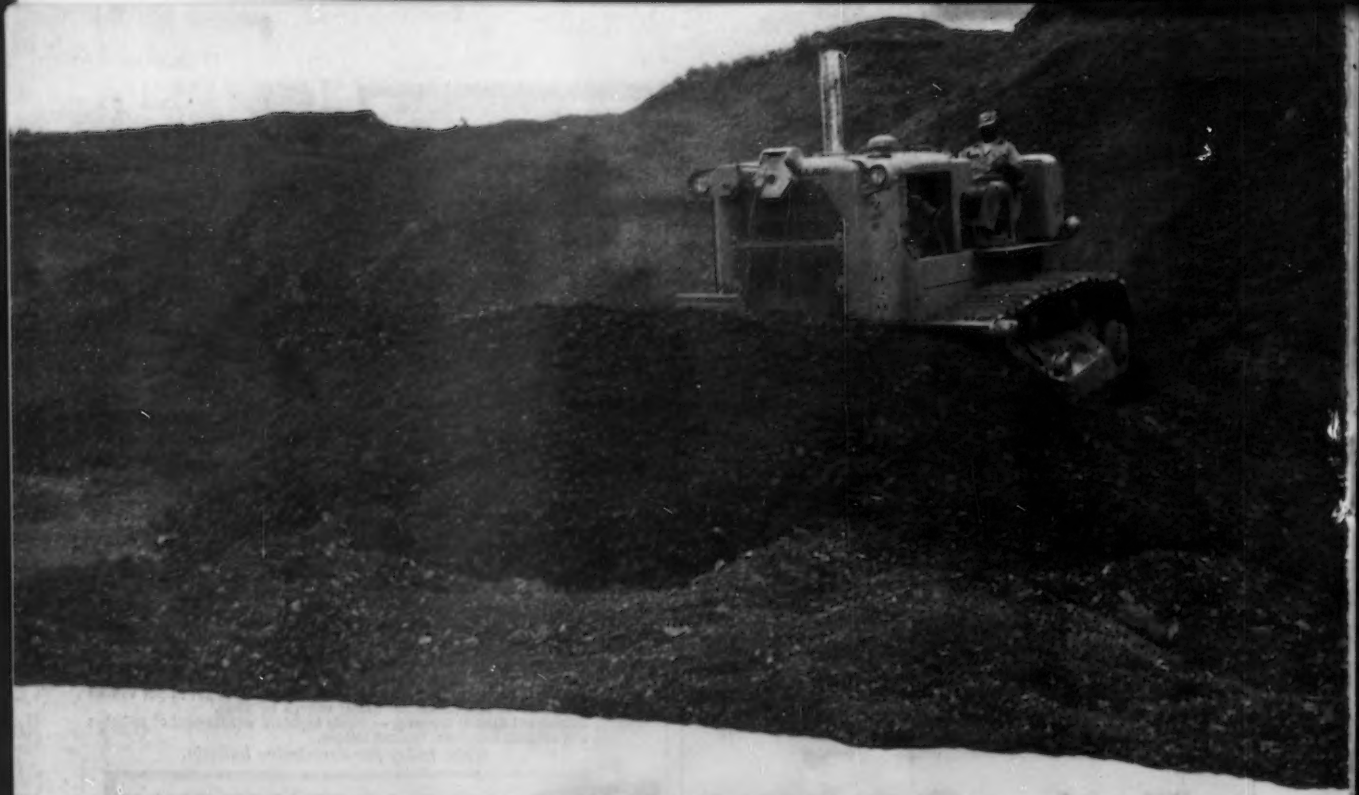
Gold Tin Columbite Titanium Bauxite

Most accurately and economically tested for . . . with the

EMPIRE DRILL

NEW YORK ENGINEERING COMPANY

75 West St., N. Y. City, U.S.A. Cable Address NYECO, N.Y.



NEW D9 TRACTOR

Moves more than 600 cubic yards of shale per hour!

This big new CAT* D9 Tractor 'dozes over 600 yds. per hour over a 100-ft. push. Its No. 9A blade handles 12 to 15 yds., trench-dozing on a 30% favorable grade. Material is shale base course for a haul road at Monsanto Chemical Co.'s Soda Springs, Idaho, phosphate mine.

Like all Cat-built equipment, the new D9s are engineered to do more work with less down time at low cost. Morrison-Knudsen Company, Inc., owns this and other giant Turbocharged 286 HP D9s here, purchased because of previous experience with Caterpillar equipment. The company also has Caterpillar D8 Tractors on this job.

The D9s are working in the phosphate beds of southern Idaho, largest known deposit in the world. The giant yellow "Kings of the Crawlers" strip overburden, which varies from 6 ft. to 10 ft. in depth, and feed ore to the shovel. These great new yellow machines are the product of many thousands of hours' testing on proving grounds and actual construction and mining jobs.

The D9 is tough and traditionally Caterpillar from its completely new, 4-cycle engine with Turbocharger to its "water quench" hardened track shoes. It's available with direct drive or torque converter for speeds to 7.8 MPH. Operators report it fast and easy to handle, with hydraulically boosted steering and brakes, "in-seat" starting, and smooth "live shaft" drive for cable controls.

It all adds up to the "workingest" tractor ever built. See your Caterpillar Dealer for details on the D9 with No. 9A or No. 9S Bulldozer blades. And count on him for fast, skilled service and Caterpillar parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

TRUCO CORING BIT

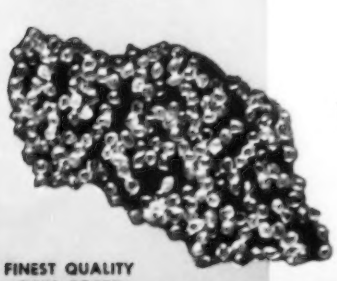
TRUCO CONCAVE BLAST HOLE BIT

TRUCO PILOT BIT

TRUCO IMPREGNATED CORING BIT

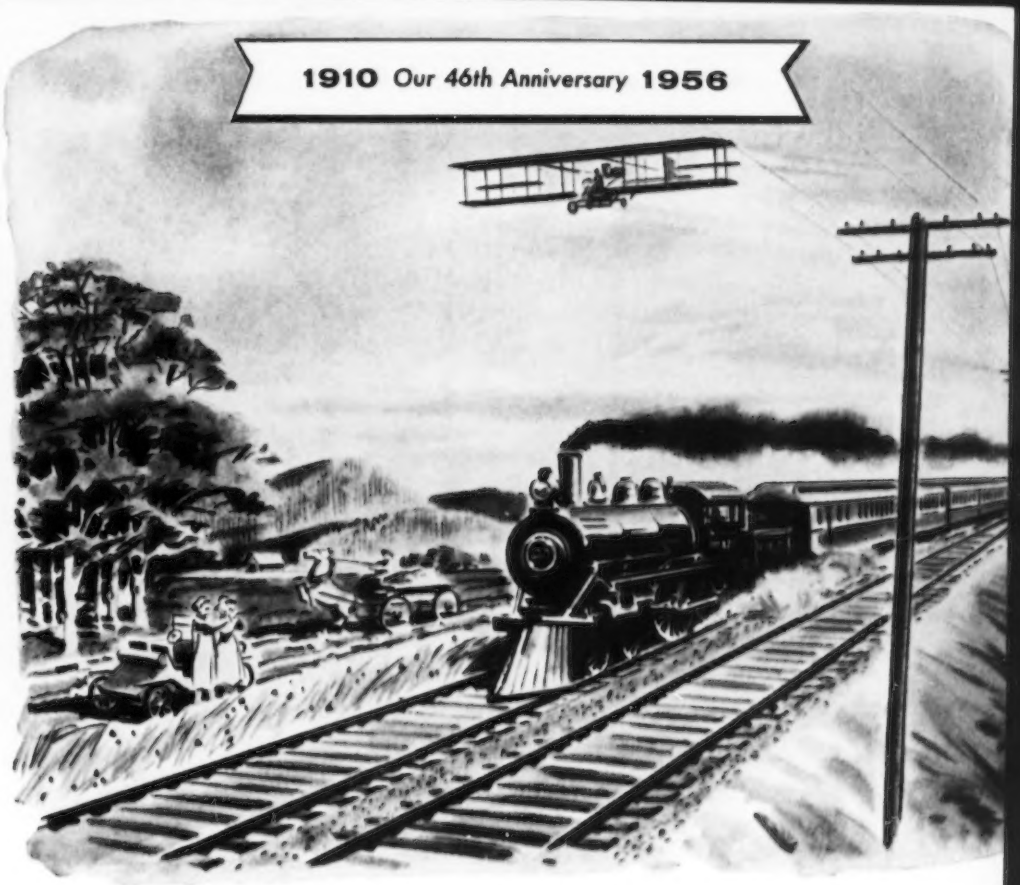
TRUCO REAMING SHELLS

TRUCO STANDARD OIL FIELD BIT



FINEST QUALITY

1910 *Our 46th Anniversary* **1956**



man on the wing

Great things were happening in aviation 45 years ago when we launched the idea of scientifically selected industrial diamonds and set up our little factory to make the diamond tools that were to be so vital to aviation.

Louis Bleriot had won $5,000 offered by London Daily Mail for the first airplane flight across the English Channel. Piloting his 24 H.P., 450 pound monoplane to the dizzy height of 250 feet, he had spanned the 21 miles of open water in 37 minutes. The challenge echoed across the Atlantic and 1910 saw a brilliant parade of dramatic "firsts."

Glenn Curtis won $10,000 offered by New York World in a 150 mile race with a train. Charlie Hamilton won $10,000 offered by New York and Philadelphia newspapers for flying a round trip between those cities in one day. Walt Brookins won $5,000 offered by Atlantic City Aero Club for reaching a height of one mile.

Ely took off from the deck of a cruiser and flew two miles to Norfolk in the first ship take-off flight. Phil Parmalee got $5,000 for flying five bolts of silk from Dayton to Columbus, Ohio, in a store publicity stunt—the first merchandise shipped by air.

Another first in those early years was Engineered Diamond Tools followed, later, by Truco Engineered Diamond Bits containing the finest selected diamonds, hand set to bring each sharpest cutting face to the work. In virtually every major drilling operation in the world these bits are now famous for fast, accurate and dependable penetration in every formation and for their ability to reduce rig time and footage costs. May we send you a copy of the Truco Diamond Bit Catalog?

TRUCO DIAMOND BITS

by

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue, Windsor, Ont., Canada

How Dodge Manufacturing Corporation designs pillow blocks that pack more capacity in less space

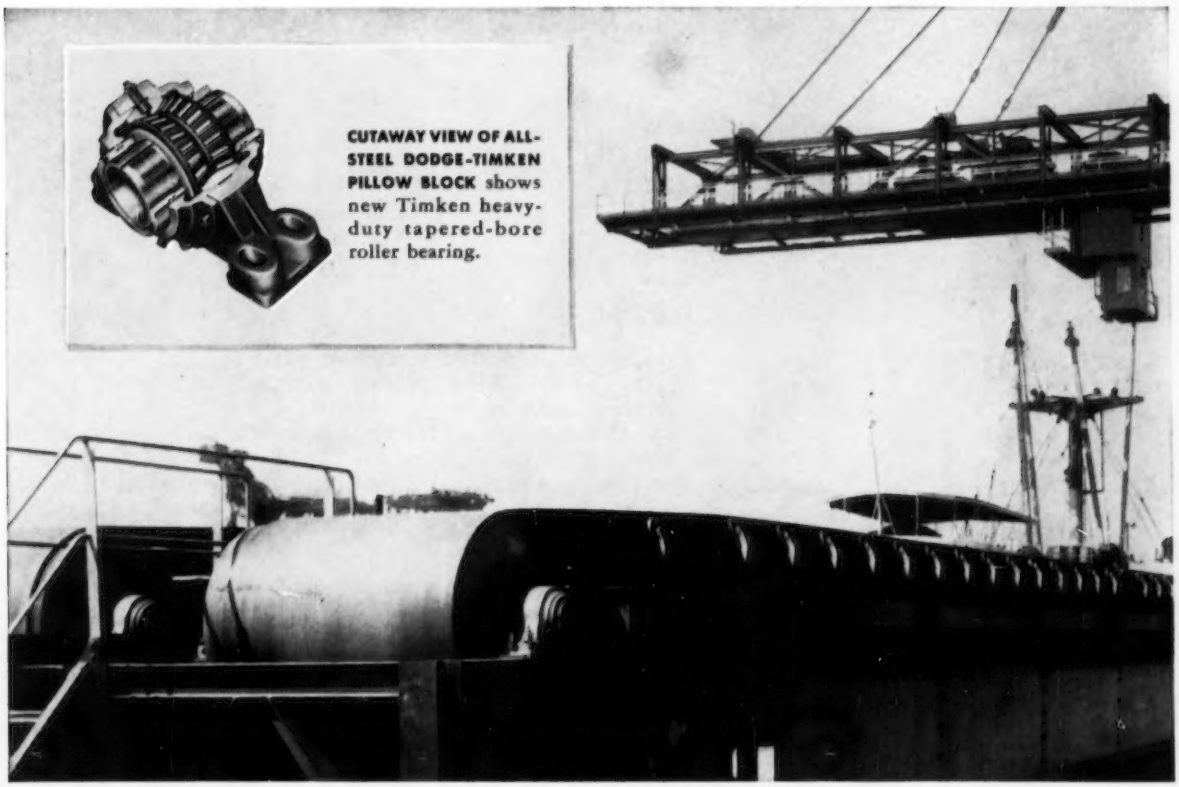
THESE design features make Dodge-Timken pillow blocks ideal for use where big load capacity in small space is needed: (1) All-steel construction gives extra strength. (2) No space-consuming special thrust devices are needed, because the Timken® tapered roller bearings used take *both* radial and thrust loads in any combination. (3) Timken bearings have high load capacity because of their *full line contact* between rollers and races.

The Dodge-Timken pillow blocks shown below support all head, tail and take-up pulleys on this conveyor belt which transports ore from ships to railroad cars. Timken bearings take the shock loads because all rollers and races are made of case-carburized steel, with tough, impact-resistant cores under hard, wear-resistant surfaces.

The Dodge-Timken All-Steel pillow blocks on this conveyor utilize a special new type of Timken heavy-duty, self-aligning tapered-bore roller bearing. The pillow block is one of many expansion and non-expansion types made by Dodge Manufacturing Corporation for general power transmission and machine applications; such as Type E, Double-Interlock, Type C and Special-Duty blocks. All are factory-sealed against abrasive dust and dirt.

Be sure you get all the advantages of Timken bearings when you buy or build pillow blocks, or any equipment. The Timken Company is America's only bearing manufacturer who makes its own steel. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



CUTAWAY VIEW OF ALL-STEEL DODGE-TIMKEN PILLOW BLOCK shows new Timken heavy-duty tapered-bore roller bearing.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

DESIGN LEADERSHIP

The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roller ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. Timken fine alloy steels.

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ▯ AND THRUST ⊣▯⊢ LOADS OR ANY COMBINATION